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BULLETINS

OF THE

State Geological and Natural History Survey of Connecticut.

1. First Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1903-1904.

2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut: by Herbert William Conn. [Out of print.]

3. A Preliminary Report of the Hymeniales of Connecticut: by Edward Albert White. [Out of print.]

4. The Clays and Clay Industries of Connecticut: by Gerald Francis Loughlin.

5. The Ustilagineæ, or Smuts, of Connecticut: by George Perkins Clinton.

6. Manual of the Geology of Connecticut: by William North Rice and Herbert Ernest Gregory.

7. Preliminary Geological Map of Connecticut: by Herbert Ernest Gregory and Henry Hollister Robinson.

8. Bibliography of Connecticut Geology: by Herbert Ernest Gregory.

9. Second Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1905-1906.

10. A preliminary Report on the Algæ of the Fresh Waters of Connecticut: by Herbert William Conn and Lucia Washburn (Hazen) Webster.

11. The Bryophytes of Connecticut: by Alexander William Evans and George Elwood Nichols.

12. Third Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1907-1908.

13. The Lithology of Connecticut: by Joseph Barrell and Gerald Francis Loughlin.

14. Catalogue of the Flowering Plants and Ferns of Connecticut growing without cultivation: by a Committee of the Connecticut Botanical Society.

15. Second Report on the Hymeniales of Connecticut: by Edward Albert White.

16. Guide to the Insects of Connecticut: prepared under the direction of Wilton Everett Britton. Part I. General Introduction: by Wilton Everett Britton. Part II. The Euplexoptera and Orthoptera of Connecticut: by Benjamin Hovey Walden.

17. Fourth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1909-1910.

Bulletins 1, 9, 12, and 17 are merely adimnistrative reports, containing no scientific matter. The other bulletins may be classified as follows:

Geology: Bulletins 4, 6, 7, 8, 13.
Botany: Bulletins 3, 5, 10, 11, 14, 15.
Zoölogy: Bulletins 2, 16.

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CATALOGUE SLIPS.

Connecticut. *State geological and natural history survey*

Bulletin No. 16. Guide to the insects of Connecticut. Prepared under the direction of W. E. Britton. Part I. General introduction. By W. E. Britton. Part II. The euplexoptera and orthoptera of Connecticut. By B. H. Walden. Hartford, 1911.

169 pp., 11 pls., 66 figs. (1 map), 23^{cm}.

Britton, Wilton Everett.

Guide to the insects of Connecticut. Prepared under the direction of Wilton Everett Britton. Part I. General introduction. By Wilton Everett Britton. Part II. The euplexoptera and orthoptera of Connecticut. By Benjamin Hovey Walden. Hartford, 1911.

169 pp., 11 pls., 66 figs. (1 map), 23^{cm}.

(Bulletin no. 16, Connecticut geological and natural history survey.)

CATALOGUE SLIPS.

Walden, Benjamin Hovey.

Guide to the insects of Connecticut. Prepared under the direction of Wilton Everett Britton. Part I. General introduction. By Wilton Everett Britton. Part II. The euplexoptera and orthoptera of Connecticut. By Benjamin Hovey Walden. Hartford, 1911.

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Zoölogy.

Britton, W. E., and Walden, B. H. Guide to the insects of Connecticut. Prepared under the direction of W. E. Britton. Part I. General introduction. By W. E. Britton. Part II. The euplexoptera and orthoptera of Connecticut. By B. H. Walden. Hartford, 1911.

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CATALOGUE SLIPS.

Insects.

Britton, W. E., and Walden, B. H. Guide to the insects of Connecticut. Prepared under the direction of W. E. Britton. Part I. General introduction. By W. E. Britton. Part II. The euplexoptera and orthoptera of Connecticut. By B. H. Walden. Hartford, 1911.

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GUIDE

TO THE

INSECTS OF CONNECTICUT

PREPARED UNDER THE DIRECTION OF

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State Entomologist, and Entomologist of the Connecticut Agricultural Experiment Station

PART I

GENERAL INTRODUCTION

By

WILTON EVERETT BRITTON

PART II

THE EUPLEXOPTERA AND ORTHOPTERA OF CONNECTICUT

By

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HARTFORD

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Part I

General Introduction

BY

WILTON EVERETT BRITTON

GUIDE TO THE INSECTS OF CONNECTICUT.

PART I. GENERAL INTRODUCTION.

The present paper is the first of a series dealing with insects, in which it is expected that ultimately the whole subject may be treated. The desirability of a published guide to the insects occurring within the boundaries of the state is beyond question; and this should include such notes regarding their characters, distribution, and habits as may prove helpful in recognizing them, so that if harmful they may be combated, or if beneficial they may be encouraged. It is impossible at the present time to prepare any accurate account of the species of all orders of insects found in Connecticut, because little attention has been given to some groups, and collections have not yet been made. Probably the most feasible plan will be to take up separately the insects in each order, or in some cases a single family may become the subject of a separate bulletin. Those groups which have received the most attention by collectors and students will naturally be the first to receive treatment; but the work must be regarded as preliminary, as it will require the efforts of many years to make it even approximately complete in all particulars.

The authority for including certain species of insects as occurring within the boundaries of the state is based upon Connecticut material in the insect collection of the Agricultural Experiment Station at New Haven. The material has been accumulating for sixteen years, though the chief portion of it has been collected during the past nine years. Other important collections are those of the United States National Museum, Washington; American Entomological Society, Philadelphia; American Museum of Natural History, New York; Museum of Comparative Zoölogy, Cambridge, Mass.; Boston Society of

Natural History, Boston; and Peabody Museum of Yale University, New Haven: all of which contain more or less material from Connecticut, the records from which have been freely used. Many private collections will probably be mentioned in the separate accounts of the orders.

It is well-nigh impossible for such a work as is here projected to be accurately carried out by any one person. The aid of specialists will therefore be invoked, in the belief that their coöperation will make the work much more complete and accurate than would be possible otherwise. Full credit will be given for such assistance.

BIBLIOGRAPHY OF THE MORE IMPORTANT WORKS RELATING TO NORTH AMERICAN ENTOMOLOGY.

General.

Manual for the Study of Insects, by J. H. and A. B. Comstock. vii + 701 pages, 6 plates, 797 figures. Comstock Publishing Co., Ithaca, N. Y. 1895.

Guide to the Study of Insects, by A. S. Packard. x + 715 pages, 15 plates, 668 figures. Henry Holt & Co., New York. Ninth edition, 1889.

The Insect Book, by L. O. Howard. xxvii + 429 pages, 48 plates, 264 figures. Doubleday, Page & Co., New York. 1901. Contains bibliography and many colored plates.

American Insects, by V. L. Kellogg. vii + 674 pages, 13 plates, 812 figures. Henry Holt & Co., New York. 1905.

Text-Book of Entomology, by A. S. Packard. xvii + 729 pages, 654 figures. The Macmillan Co., New York. 1898. Especially devoted to structure and physiology, and contains bibliography.

Entomology with Special Reference to its Biological and Economic Aspects, by J. W. Folsom. vii + 485 pages, 5 plates, 300 figures. P. Blakiston's Son & Co., Philadelphia, 1906. Especially devoted to structure and development, and contains bibliography.

American Entomology, by Thomas Say. 2 volumes. 54 plates, 412 + 814 pages. Le Conte edition, 1869.

Elements of Insect Anatomy, by J. H. Comstock and V. L. Kellogg. 145 pages, 11 figures. Comstock Publishing Co., Ithaca, N. Y. Third edition, 1901.

Insects of New Jersey, by J. B. Smith. 755 pages, 329 figures. New Jersey State Board of Agriculture. 1899. An annotated and illustrated list of the insects of the state.

Explanation of Terms Used in Entomology, by J. B. Smith. vii + 154 pages, 4 plates. Published by the Brooklyn Entomological Society, Brooklyn, N. Y. 1906.

Journals.

Canadian Entomologist (monthly), Volumes 1-40, 1869-date. London, Ontario, Canada.

Entomological News (ten numbers annually), Volumes 1-19, 1890-date. Academy of Natural Sciences, Philadelphia, Pa.

Psyche (bi-monthly, Volumes 1-15, 1877-date. Cambridge Entomological Club, Cambridge, Mass.

Journal of the New York Entomological Society (quarterly), Volumes 1-16, 1893-date. Published by the Society, New York.

Reports of Ontario Entomological Society. 38 volumes, 1870-date. Index volumes 1-30. Published by the Ontario Department of Agriculture.

Bulletin Brooklyn Entomological Society, Volumes 1-7, 1878-1884. Published by the Society, Brooklyn, N. Y.

Entomologica Americana, Volumes 1-6, 1885-1890. Published by Brooklyn Entomological Society, Brooklyn, N. Y.

Proceedings Washington Entomological Society, Volumes 1-10, 1884-date. Published by the Society, Washington, D. C.

Proceedings Entomological Society of Philadelphia, Volumes 1-6, 1861-1867. Published by the Society, Philadelphia, Pa.

Transactions of the American Entomological Society, Volumes 1-35, 1867-date. Published by the Society, Philadelphia, Pa.

Economic.

Insects Injurious to Vegetation, by T. W. Harris. xi + 640 pages, 8 plates, 278 figures. Crosby & Nichols, Boston. Flint edition, 1863.

Economic Entomology, by J. B. Smith. xii + 481 pages, 483 figures. J. B. Lippincott Co., Philadelphia. 1896.

Our Insect Friends and Enemies, by J. B. Smith. 314 pages, 121 figures. J. B. Lippincott Co., Philadelphia. 1909.

Insects Injurious to Fruits, by W. Saunders. 436 pages, 440 figures. J. B. Lippincott Co., Philadelphia. Second edition, 1900.

Insects and Insecticides, by C. M. Weed. 334 pages. Orange Judd Co., New York.

Injurious Insects and the Use of Insecticides, by F. W. Sempers. x + 216 pages, 184 figures. W. Atlee Burpee & Co., Phila. 1894.

Insects Injurious to Staple Crops, by E. D. Sanderson. x + 295 pages, 162 figures. John Wiley & Sons, New York. 1902.

Insects Injurious to Vegetables, by F. H. Chittenden. xiv + 262 pages, 163 figures, bibliography. Orange Judd Co., New York. 1907.

Bibliography of Economic Entomology, by S. Henshaw and N. Banks. Parts 1-8, 1890-1905. Published by U. S. Department of Agriculture, Washington, D. C.

Reports on the Noxious, Beneficial, and Other Insects of Missouri, by C. V. Riley, 1-9 with index, 1869-1877.

United States Entomological Commission, Reports 1-5, 1877-1890. Published by the U. S. Department of Agriculture, Washington, D. C.

Insect Life. 7 volumes with index. Published periodically by the U. S. Department of Agriculture, Washington, D. C. 1888-1895.

Bulletins 1-33; N. S., 1-89, Bureau of Entomology: 1895-date. Index volumes 1-30. Bulls. 24 and 81 contain bibliography. Also Circulars 1-96, Technical Bulletins 1-14, and Farmers' Bulletins. Published by U. S. Department of Agriculture, Washington, D. C.

Noxious Insects of New York, by A. Fitch, Reports 1-14. Published by the New York Agricultural Society. 1856-1870.

Reports of State Entomologist of New York. 22 Volumes. 1-13 by J. A. Lintner, 13-22 by E. P. Felt. 1882-date.

Reports on Insects of Illinois. 23 volumes. Vol. 1 by B. D. Walsh, 1867. 2-5 by Wm. Le Baron, 1868-1874. 6-9 by C. Thomas, 1875-1880. 10-22 by S. A. Forbes, 1880-1905.

Reports and Bulletins of the State Agricultural Experiment Stations contain much entomological matter. The publications of the Connecticut Station at New Haven contain the nine reports of the State Entomologist (1901-1909) which deal with Connecticut insects.

Journal of Economic Entomology (bi-monthly, started in 1908). Official organ of the Association of Economic Entomologists, containing the proceedings of the association. (Previously the proceedings were printed in Insect Life, and as Bulletins of the Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C.)

The publications here listed do not include those of a special nature such as the monographs of separate orders or families of insects. These will doubtless be listed in the future publications referring to the various groups. Any one wishing to learn about these special lists and monographic papers may consult the bibliographies in Howard's Insect Book and in Bulletins 24 and 81 of the Bureau of Entomology.

ABUNDANCE OF INSECTS.

Insects are of small size, and are among the most abundant of animals. Not only are the individuals very numerous, but the number of species is probably greater than that of all other land animals. About 400,000 species have been described throughout the world, and it has been estimated that several million species exist. For a given locality the number of species is much less, yet some parts of the world are almost wholly unexplored as regards insect life. The number of species that occur in Connecticut is of course much smaller than that of the whole continent, and may be expected to aggregate between 6,000 and 10,000.

Though found all over the earth, even in the arctic regions, insects are most abundant in the tropics. It is here also that we find the largest and most brilliantly colored species. But some of our own species are no less interesting, if less gorgeous.

HABITS AND HAUNTS OF INSECTS.

Most species of insects are terrestrial, though many forms are aquatic, the familiar examples being water bugs and water beetles. Certain other insects, like dragon-flies, caddis-flies, stone-flies, may-flies, mosquitoes, and some other Diptera, are aquatic during the larval stage, but fly about in the air as adults.

A large proportion of the various kinds of insects feed upon living plant tissues, either destroying the foliage, or boring in the wood of the stem, root, or branches. Others live in the soil and devour small roots of trees and plants. Dead and decaying plant tissues also form the food of a large number of species, and such conditions are found chiefly in connection with the soil. We find also in the soil certain other kinds that do not eat plant tissues, but feed upon the animal life therein; such insects preying upon other living forms are said to be predaceous or predatory, and may attack other kinds of insects or perhaps certain other small animals. Beetles of the family Carabidæ are a good example, though some kinds are not always found in the soil, but frequent trees and fly about in the air in search of their prey. Some of the two-winged flies (order Diptera) and hornets (order Hymenoptera) have the same habit. Beetles of the families Silphidæ and Staphylinidæ are known as carrion beetles, and, in company with two-winged flies known as carrion flies, are found about dead animals of all kinds. The beetles feed upon the decaying animal matter, and the flies breed therein, their larvæ feeding upon it.

A host of the insects are animal parasites. The biting lice or bird lice (order Mallophaga) and the sucking lice of mammals (order Hemiptera) are small insects, mostly light colored or transparent, feeding upon the blood or skin of the host, and frequenting the most protected parts of the body, where they crawl about among the hairs. Other parasites of a similar nature are the sheep ticks (order Diptera) and fleas (order

Siphonaptera). The bot-flies (order Diptera) are internal parasites, the eggs being laid upon hairs and taken into the stomach of the host through the mouth; the larval stage is passed in the host.

Many four-winged flies (order Hymenoptera) and two-winged flies (order Diptera) are parasitic upon other insects. The egg is usually laid on or in the body of the larva of the host; and, after hatching, the young grubs or maggots feed therein until ready to transform, the host usually living just long enough to mature the parasites. By far the greater part of these insects are of small size and belong to a group commonly known as parasitic Hymenoptera.

In nature we find a balance between host and parasite. A certain species may, on account of abundance of food, become prevalent, and, if parasites are scarce, it will increase in numbers rapidly; but, when it becomes prevalent, it in turn furnishes for the parasites an abundant supply of food, which, other things being equal, enables them to multiply rapidly and soon overtake their host in point of numbers and finally subdue it. The host will then be scarce for a period, and on account of lack of food the parasites must of necessity be kept in check until again the host becomes abundant, when a corresponding increase in parasites will follow. Thus host and parasites play a veritable game of see-saw with each other in scarcity and abundance. Under these conditions no species is allowed to dominate the earth, but in the long run every species is kept in check by natural enemies.

The illustrations here given refer only to simple parasitism. In nature the case is usually much more complex, because the primary parasites are attacked by other parasites which are known as secondary parasites. The latter in turn may be parasitized by tertiary parasites, and so on. The term hyperparasite includes all except the primary parasite.

Nevertheless, in spite of the complexity, nature is able to preserve a sort of balance between her various organisms. It is only when nature's balance is disturbed that we find certain species overrunning the earth and crowding out others. Man has been the disturbing factor, by cutting off the forests and native vegetation, thus destroying food supply; by growing large

areas devoted to a single crop; by carrying insects from one part of the world to another in connection with the transportation of products carried on by his commercial enterprise. Usually, when insects are transported to a new country, their parasites and other natural enemies are left behind; hence, when they become established, they are able to multiply with great rapidity, and often do much damage. Such has been the history of the gypsy moth, the elm-leaf beetle, the cabbage worm, the San José scale, and a score or more of other pests.

Some of the bees, wasps, and ants (order Hymenoptera) and the termites or white ants (order Neuroptera) are social in their habits, and live together in colonies, each colony occupying a nest. There is one queen in each colony, sometimes more than one, and the queen lays the eggs to increase the colony. In these communities of social insects the males are often called drones. Their function is to fertilize the queen; there are usually complemental females which are capable of reproduction in case the queen perishes. The great majority of the members of these colonies are called workers or neuters, but are really females imperfectly developed. They serve the community by feeding and caring for the young and by building the nests.

Most insects are not social, and do not live together in colonies, though many are gregarious to the extent that those hatching from a single egg-mass deposited by the female parent remain and feed together during a portion or the whole of their larval development. Many insects are solitary, and are not found together at all except perhaps when in search of food.

DISTRIBUTION OF INSECTS, AND THE LIFE ZONES OF CONNECTICUT.

It has long been known that natural laws govern the distribution of native insects as well as of other animals and plants. For instance, we find vegetation on the mountain tops quite different from that growing in the valleys, and the flora of a desert in no wise resembles that of a swamp. In like manner we should expect to find faunal areas containing certain forms or species of insects which differ from the species occurring in other regions where the climatic conditions are different. Insects of the marsh along the coast are not the same as those of the high mountains, and those of the tropics are entirely dif-

ferent from those of the arctic regions. Thus latitude and altitude, as they affect temperature, and moisture or the lack of it, exercise important influences upon the distribution of insects.

In order to designate approximately the various natural areas of the United States in connection with the distribution of organisms, we speak of the Boreal, Austral, and Tropical regions. Each region is further divided into zones, beginning at the north, as follows: Arctic-Alpine zone, which is above the limit of tree growth; Hudsonian, extending from Labrador to Alaska, and including the northern portion of the great forests of spruce and fir; Canadian, comprising the southern portion of the coniferous forests, and the greater part of Canada, northern New England, the Adirondacks and high mountains of the Alleghanies, northern Michigan and Minnesota, and the higher parts of the Rocky Mountain region. The Transition zone is considered as marking the region where the Boreal and Austral elements overlap; and takes in most of the New England territory and the Alleghanian region, extending across the northern part of the United States, and includes also the greater portion of the Rocky Mountain region except the low valleys and deserts, which belong to the Austral, and the high mountains, which belong to the Canadian zone. The eastern portion of the Transition zone, which is humid, is often called the Alleghanian, in contradistinction to the more arid western or Pacific Coast Transition. The Upper Austral zone extends along the coast from Southern New England to Chesapeake Bay, and then southward each side of the mountain region and westward through the Central States and the valleys of the Rocky Mountain region. The eastern portion is often called the Carolinian zone. The Lower Austral extends from Chesapeake Bay along the coast to Mexico. and includes portions of Arizona and southern California.

Any one interested in these life zones, and the fauna, flora, and agricultural crops peculiar to each, should procure a copy of Dr. C. Hart Merriam's bulletin,* which explains the matter more fully and contains a map showing the extent of each zone. In order to show the relation of these zones to Connecticut, the accompanying map (see Fig. 1) has been adapted from Dr.

*Life Zones and Crop Zones. Bulletin No. 10, Division of Biological Survey, U. S. Dept. of Agriculture, Washington, D. C., 1898.

Merriam's map, and references to these zones will be found in the forthcoming papers. The reader will notice that the Upper Austral extends over a narrow area along the coast and up the Connecticut River beyond the northern boundary of the state, and that the remaining portion is Transition. Very little field work has been done in Connecticut to establish the limits of these zones; but we find that certain species occur along the valleys of the Housatonic, Naugatuck, and Quinnipiac Rivers much farther north than the limits of the Austral zone as shown by the map. As these species do not occur in other Transition portions of the state, it is expected that the map must be modified considerably after further study of the plants and animals.

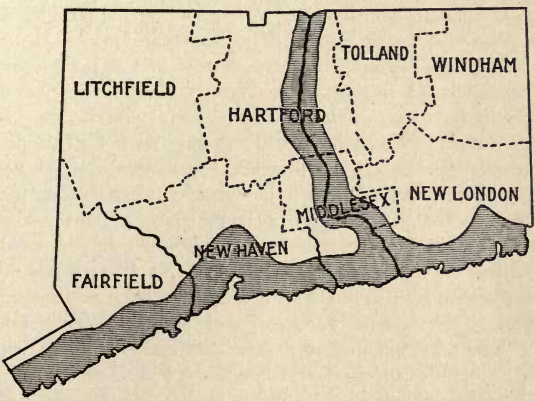


FIG. 1. Map of Connecticut showing the Life Zones in the State. The shaded portion represents the Upper Austral, and the unshaded portion the Transition. (Adapted from the map of Dr. C. Hart Merriam.)

ECONOMIC STATUS OF INSECTS.

Man is accustomed to classify insects as injurious or beneficial to human interests. In general, people regard insects as being injurious, and give them little credit for the benefits which mankind derives from them. A few years ago Dr. L. O.

Howard, in an address before the Washington Biological Society, pointed out those families of insects which could be called distinctly injurious or distinctly beneficial, and found that they were about equally divided, as follows:

Injurious,	116	families.
Beneficial,	113	"
Both, or undetermined,	71	"
	300	"

It will be seen at a glance, therefore, that there are about as many insects which are distinctly beneficial to man as there are which cause him injury. The great majority of insects are neither friends nor foes to man in any important degree, but each species fills a place perhaps no less important in relation to other organisms.

How Insects are Injurious.

Insects are regarded as injurious if they destroy crops, like the potato beetle, and if, like the elm-leaf beetle, they attack highly prized shade trees, or, in fact, any other plant life which seems desirable to man. This is perhaps the most important injury caused by insects, and it has been estimated that fully one-tenth of all the agricultural crops of the United States, or a value of more than $700,000,000, is annually destroyed by insects. Methods of spraying and other forms of remedial treatment have been devised to prevent or check such destruction, and this phase of the subject has reached a higher development in the United States than elsewhere.

Certain kinds of insects also cause injury to stored foods, books, and clothes, and to dwelling houses. Other kinds attack live stock and other useful animals, and a few species annoy man. Recently it has been discovered that insects are more important as carriers of disease than was formerly supposed. Certain mosquitoes are the essential hosts of the malarial parasite, and it is only through their bites that these parasites are naturally transferred to man. Another kind likewise transmits yellow fever through its bites, and the disease called elephantiasis is transmitted to man by mosquito infection.

Germs of many intestinal diseases, like cholera and typhoid fever, and of other germ diseases, like bubonic plague and anthrax, are often carried mechanically on the feet or body of the common house fly, which breeds in and frequents foul matter, and then crawls over food. Both food and foul matter should be inaccessible to flies.

Certain gadflies are known to carry diseases of cattle.

Methods of Controlling Injurious Insects.

The insect enemies of crops may be divided roughly into two classes: (1) those which bite or chew their food, and (2) those which suck out the plant juices for nourishment. To the former class belong those insects which devour portions of the plant, such as the borers, and all leaf-eating forms like the Colorado potato beetle, the elm-leaf beetle, canker-worms, the gypsy moth, and many others. The insects of the latter class, though less evident, are no less destructive, and include the San José and all other scale insects, and the aphids or plant lice.

Pests are commonly controlled by spraying, and by mechanical means such as traps, barriers, etc. Spraying with internal poisons is the best means of destroying the leaf-eating insects, and for this purpose Paris green and lead arsenate are used. The formulas are given herewith:

Lead Arsenate		*Paris Green*	
Lead arsenate	3 lbs.	Paris green	1 lb.
Water	50 gals.	Lime	3 lbs.
		Water	100 gals.

Lead arsenate is manufactured in paste form, will adhere much longer to the foliage, remains better in suspension, and causes no injury to the foliage even when used in excessive quantities.

Paris green, on the other hand, is a dry powder, and may be mixed with land plaster or air-slaked lime and sifted upon the plants. It contains some free acid which is liable to injure foliage, settles quickly in water, and washes off easily. The addition of lime improves the sticking qualities, and neutralizes the free acid, and thus prevents injury to the foliage.

These poisons may be, and often are, used in Bordeaux mixture in orchard practice. Bordeaux mixture is a fungicide

composed of copper sulphate and lime, and the lime being in excess prevents any injury occurring from the Paris green.

Hellebore acts as an internal poison and also as an external irritant, and is especially effective when used against the larvæ of sawflies, such as the imported currant worm. Hellebore may be used as a dry powder, or mixed with water in the ratio of one ounce to two gallons.

Sucking insects must be killed by other methods, as they insert their tiny beaks into the tissues and suck out the sap, and would not therefore obtain poison which was applied to the surface of the leaves.

It is necessary to destroy them by some application which on coming in direct contact with their bodies will kill, either by irritating or corroding them, or by stopping up their breathing pores and suffocating them. Various oil emulsions have the latter effect, and soap mixtures act in both ways, especially if they contain free potash. Kerosene emulsion may be made as follows:

Kerosene	2 gals.
Common soap	½ lb.
Water	1 gal.

Dissolve the soap in hot water, add the kerosene, and churn together until a white, creamy mass is formed which thickens on cooling. Dilute with nine times the amount of water before using.

Common laundry soap dissolved in the ratio of one pound in eight gallons of water is an excellent contact insecticide, and is effective against most plant lice.

For several years the lime and sulphur mixture has been the chief remedy for trees infested by the San José scale insect, *Aspidiotus perniciosus* Comst.

Lime and Sulphur Mixture

Fresh finishing lime	20 lbs.
Fine sulphur flour	14 lbs.
Water	40 gals.

Boil one hour, and apply while fresh to dormant trees.

The so-called " soluble " or miscible oils which are now being recommended instead of the lime and sulphur mixture, are really emulsions.

Insecticides are usually applied in the form of a spray, by means of a pump. In large orchards power sprayers are in vogue, but for smaller operations hand pumps are preferable. Advice regarding the most desirable forms of spraying apparatus may be obtained from any agricultural experiment station.

Other control methods consist in the use of poisoned bait, traps, sticky bands, hopper-dozers, and barriers, but these are for special use against certain kinds of insects. Crop rotation and cultural methods are practiced to forestall injury by certain species. Poisonous gases are also employed when they prove effective and inexpensive, — as in fumigating nursery stock and greenhouses with hydrocyanic acid gas to kill the San José scale, and in treating stored grain with carbon disulphide to kill the insects infesting it.

With certain other pests it is necessary to destroy their breeding places in order to control them. This is done in case of mosquitoes, certain kinds of which transmit yellow fever and malaria to man through their bites. It has recently been discovered that bubonic plague is transmitted to man through the bites of certain kinds of fleas which naturally live upon rats. The destruction of the rats is therefore the chief preventive measure in regions where this disease is prevalent.

How Insects are Beneficial.

The greatest benefit which man derives from insects is through the part which insects play in plant pollination. A large proportion of plants, including some of the fruits and other cultivated crops, depend on insects to carry pollen from one plant to another. Without these insects there could be no crop. Insects aid man by destroying other insects and plants which are injurious or undesirable. To some extent they are scavengers and makers of soil, whereas to a large extent they serve as food for birds and fishes, and to a limited extent as food for man. Honey and beeswax are two important products of insects, and honey is an important addition to man's food. Wax and lac are used extensively in the arts, and silk is an extremely important material used as clothing. A large proportion of the food of poultry and song birds is composed of insects.

CHARACTERS THAT DISTINGUISH INSECTS FROM OTHER ANIMALS.

Insects are articulated animals having six legs. They comprise the class *Hexapoda* (*Insecta*) of the phylum or branch *Arthropoda*, to which the spiders, centipedes, and crustacea also belong. Certain differences in structure may serve to distinguish insects from their allies, and some of these are set forth in the following table:

Phylum **Arthropoda.**

Animals with a tough or hardened exterior, transversely segmented, and bilaterally symmetrical.

1. Respiration aërial, by tracheæ or lungs..... 2
   Respiration aquatic, by gills or by the general integument; two pairs of antennæ; head and thorax usually consolidated .....**Crustacea**
2. Head distinct 3
   Head and thorax united to form cephalothorax; abdomen distinct; antennæ wanting; eight legs..**Arachnida**
3. Head, thorax, and abdomen distinct; six legs and one pair of antennæ .....**Hexapoda**
   Thorax and abdomen not differentiated, formed of a large number of similar segments, each bearing one or two pairs of legs; one pair of antennæ....**Myriapoda**

Class **Hexapoda** or **Insecta** includes all of the insects — a class far more numerous in species than any other class of animals. Except in some specialized forms, all have six legs in the adult stage.

Myriapoda. Centipedes and millipedes, commonly known as thousand-legged worms. The large number of legs and the lack of differentiation of thorax and abdomen serve to distinguish this from other classes.

Arachnida. Spiders, mites, scorpions, and ticks. Though of some diversity of form, the lack of antennæ and the number of legs make it easy to recognize the members of this class.

Crustacea. Crayfish, lobsters, crabs, etc. Though some members of this class live out of water, they still breathe through gills or through the integument and live in moist places. The Crustacea have typically two pairs of antennæ. The highest

and best-known group represented by crabs and lobsters have ten legs; but in the lower and less familiar groups the number of legs varies.

EXTERNAL STRUCTURE OF INSECTS.

Generally speaking, all mature insects are covered with a hardened exoskeleton formed of chitin. This serves for the attachment of the muscles and for the protection of the vital organs. The trunk is divided into three more or less distinct regions; viz., head, thorax, and abdomen. Immature insects do not always show these divisions.

Head.

The head bears the eyes, the mouth-parts, and the antennæ or feelers. The eyes of adult insects are usually compound; that is, made up of a large number of simple eyes placed close together, each having the form of a hexagon, and the whole resembling a piece of honeycomb. The simple eyes that go to form the compound eye are known as facets, and vary from about fifty in the eyes of certain ants, to nearly a thousand, as is the case with butterflies and dragon-flies. In addition to the compound eyes there are isolated simple eyes, called ocelli, often placed on the front of the head between the compound eyes.

A pair of jointed antennæ, usually situated between and in front of the compound eyes, serve as organs of touch. The antennæ vary greatly in size and shape in the different kinds of insects, some having antennæ which are filiform, some clavate, some feathery, etc. The antennæ of the sexes often differ, those of the male usually being more prominent.

The mouth-parts are fitted either for biting or for sucking. Biting mouth-parts consist of an upper lip (labrum) and an under lip (labium), between which are two pairs of jaws that move horizontally. The upper jaws are called mandibles, and are for tearing off the food; the lower jaws are known as maxillæ, and bear jointed appendages called maxillary palpi. The labium is furnished with jointed appendages called labial palpi.

Sucking mouth-parts consist of a jointed tube or proboscis

through which the liquid is drawn, often containing needle-like organs called lancets for puncturing the tissues. The proboscis is formed by a modification of either the labium or the maxillæ.

The structure of the mouth-parts is of great importance, not only in classification but also in practical work with insects, as the application of insecticides depends upon the structure of the mouth-parts.

Thorax.

The thorax is made up of three ring-like segments known respectively as pro-, meso-, and metathorax, and bears the organs of locomotion. Wings, when present, are borne dorsally by the meso- and metathorax, but one or both pairs may be absent. Flies have only the first pair of wings fitted for flight, the second pair being represented by a pair of knobbed threads, called *halteres* or balancers, the function of which is not well understood. In earwigs and beetles a pair of veinless horny wing covers takes the place of the first pair of wings. Grasshoppers, crickets, and locusts have a pair of closely veined, leathery fore wings which are used in flight.

The veins or nerves of the wings are designated by letters and numbers. The spaces between the veins are called cells, and are similarly designated. Wings of butterflies and moths are covered with scales, which give them their color patterns. Each segment of the thorax bears ventrally a pair of jointed legs; each leg consists of coxa, trochanter, femur, tibia, and tarsus. The tarsus is often many jointed and terminates in a claw.

Abdomen.

The abdomen bears the organs of reproduction, and is made up of simple and distinct ring-like segments, varying in the different insects from three to nine in number. In the lowest order of insects, Thysanura, are found some forms with abdominal legs, but in no other adult insects are locomotive organs attached to the abdomen. In caterpillars and other larval forms fleshy appendages known as prolegs or false legs are borne upon the ventral surface of the abdomen.

The apex or distal extremity of the abdomen is furnished with various appendages in the different families of insects, such

as cerci, caudal setæ, claspers, ovipositors, stings, and cornicles or honey tubes.

INTERNAL ANATOMY.

The muscles are transparent and colorless, or of a yellowish white color, those moving the body segments being fastened to the body wall. These muscles are very strong, and are capable of rapid motion. Physicists have estimated that certain gnats move their wings at the rate of 15,000 times per second, the estimate being based upon the pitch of the musical note produced.

Insects breathe through a series of openings called spiracles, along the sides of the thorax and abdomen. Each segment bears two of these spiracles, one on either side, and the openings, though often simple, are sometimes provided with valves or fringes of hair to keep out the dust. Connecting with the spiracles are a series of air tubes or tracheæ which ramify through the body of the insect. Aquatic insects are provided with special devices for respiration, most immature forms having tracheal gills, but in a few dragon-flies and some stone-flies tracheal gills are retained throughout the insect's existence. A mosquito larva has a tube at the posterior extremity of the body which is protruded from the surface of the water for the purpose of obtaining air. Certain aquatic Hemiptera called back-swimmers and water-boatmen carry down bubbles of air under their folded wings.

The blood is a thin, watery fluid, and does not flow through a system of closed tubes, as in the higher animals, but fills the entire body cavity not occupied by other organs. There is a single longitudinal blood vessel above the alimentary canal, pulsatile in its posterior part, and provided with valves which permit the blood to move only toward the anterior extremity of the vessel, where it is discharged into the body cavity.

The alimentary canal is a tube extending through the body. In adults this is much longer than the body, and is more or less folded, but in caterpillars it is only a straight tube reaching from one end of the body to the other. Fatty tissues make up a large portion of the contents of the body cavity.

The nervous system in insects is more highly developed than in other invertebrates. A large ganglion in the head is analogous to the brain of vertebrates, and is connected with a series

of ganglia, one for each body segment, situated beneath the alimentary canal, on the floor of the body cavity.

All insects are developed from eggs, and in most cases oviposition takes place on or near the host or food plant. Some insects, however, retain the eggs within the oviducts until they are developed, and accordingly bring forth living young. These insects are said to be viviparous. In many of the plant lice, a number of generations are produced viviparously and without fertilization, after which another generation is produced in the normal fashion from fertilized eggs. The external reproductive organs are usually situated at the extremity of the abdomen.

SENSES OF INSECTS.

Insects seem not to be very sensitive to pain; and some kinds will live for hours if head or abdomen be severed from the thorax.

Sight is well developed, and the eyes are best understood of all sense organs. Though larvæ have only ocelli or simple eyes, adults have also compound eyes, which are very large in dragon-flies and some other insects, enabling them to see in all directions at once.

Hearing is a sense supposed to be possessed by insects from the fact that many species sing or stridulate. The ears of grasshoppers are on each side of the basal segment of the abdomen, and crickets have them on the tibiæ of the fore legs.

Taste is unquestionably a matter of fact in insect life, because the various species are able to discriminate between foods, though perhaps attracted to their food by the sense of smell, which is very highly developed. There is no organ corresponding to a nose, but the sense of smell is supposed to be situated in the antennæ, and males have it developed more highly than females; by it the former are able to find the latter, and both sexes find their food even by night.

GROWTH AND METAMORPHOSES OF INSECTS.

The most primitive order of insects (Thysanura) have no transformations or metamorphoses, but the young, except in size, resemble the adults. Most kinds of insects, however, pass

through four distinct stages in their life cycle; namely, egg, larva, pupa, imago. (See Fig. 2.)

We are all familiar with the egg of the potato beetle, which is laid on the under side of the leaf. Of many different forms are the eggs of the various kinds of insects, some being globular, some elongated, some smooth, others elaborately sculptured and

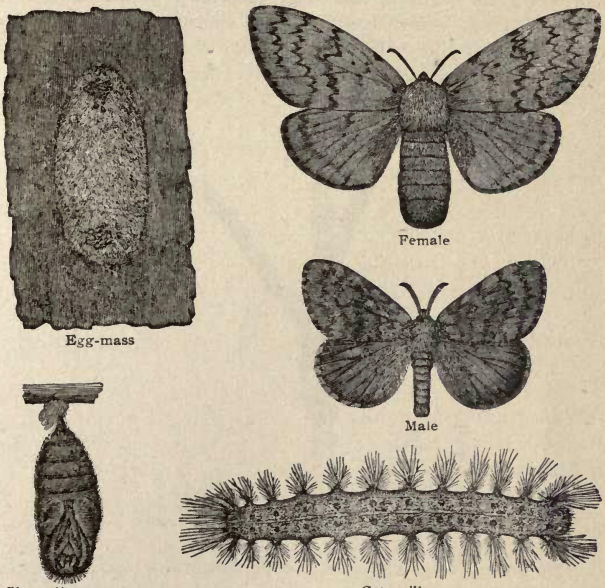


FIG. 2. The four stages in the life cycle of an insect: Gypsy moth, *Porthetria dispar*. All figures natural size.

very handsome. Most of them are of small size, some laid singly and others in large masses. The eggs of flies hatch in a few hours; but the eggs of the tent caterpillar (*Malacosoma americana* Harr.), shown in Fig. 3, and of the gypsy moth (*Porthetria dispar* Linn.), shown in Fig. 2, remain on the trees from July to the following May, or about nine months, before hatching. These cases well represent the extremes to be found

in Connecticut insects as regards the time required for the eggs to hatch. Many species pass the winter in the egg stage.

The larva is the stage during which the insect feeds and increases in size, casting its skin, or molting, from time to time. The larva of a moth or butterfly is commonly called a caterpillar, that of a fly is known as a maggot, and that of a beetle is often called a grub. It is in this stage that most of the damage is done by insects. Few insects require more than a year in this stage, most of them but a few weeks, and some only a few days or hours. A number of species winter as larvæ.

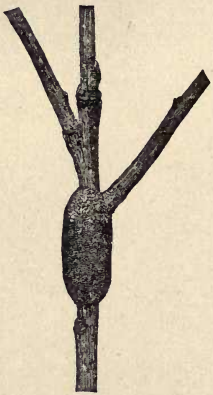


FIG. 3. Egg-mass of Tent Caterpillar on apple twig. Natural size.

The pupa, called chrysalis in the butterflies and moths, is the quiescent or non-active stage assumed by the larva when fully grown. The tissues inside break down almost completely to a homogeneous mass of protoplasm, and from this the various parts of the adult, beginning with the head and brain, are formed. The insect thus emerging is entirely different from both larva and pupa, a state of affairs not occurring so markedly in any animals outside of the insects. A large number of species pass the winter in this stage, but some of the flies require but a few hours or days in the pupa stage. Sometimes the pupa is naked, but often a cocoon of silk threads is

made by the caterpillar before transforming. Many insects pupate in the ground.

The imago or adult is the mature insect, fitted for reproduction, after which it lives but a short time. This is the only stage in which we find fully developed wings. The adults of many insects take very little or no food except perhaps the nectar of flowers or the juices from mutilated plants or animals. Beetles, however, feed as well as their larvæ, and in some cases do quite as much damage, and the adults of some other orders also take food. Many insects pass the winter as adults, going into protected places such as buildings, or under stones, fences, or rubbish.

Insects having the four well marked stages just described are said to have complete transformations or metamorphoses. Among these are included the butterflies and moths (Lepidoptera), beetles (Coleoptera), flies (Diptera), bees and ants (Hymenoptera).

Most of the other insects, and especially the Orthoptera (grasshoppers, crickets, etc.), and the Hemiptera (plant lice, scale insects, and true bugs) do not pass through these four stages, but from the egg something hatches resembling the mature insect. These are said to have incomplete transformations or metamorphoses. Here we have three stages; namely, egg, nymph, imago. The nymph feeds and increases in size, molting from time to time, and having a somewhat different appearance after each molt, but gradually approaching the size and appearance of the imago or adult.

Many of these insects cause injury to plants in the adult as well as in the nymph stages, and the winter may be passed in each of the three stages. Thus almost all grasshoppers lay eggs in the fall, and these do not hatch until the following spring; but nymphs of certain species may be found on warm days late in autumn and early in spring; while some of the true bugs, like the squash bug (*Anasa tristis* DeG.), crawl into protected places and pass the winter season as adults.

CLASSIFICATION OF INSECTS.

The following analytical key has been adapted from the key arranged by Prof. H. E. Summers and given in Kellogg's *American Insects*. It applies only to adult insects.

Key to Orders.

1. Mouth-parts projecting, or not withdrawn into a cavity in the head. Normally with wings, which are sometimes rudimentary or wanting 2
   Mouth-parts withdrawn into a cavity in the head. Wingless insects, sometimes having abdominal legs, and feet having one or two claws.....**THYSANURA**
2. Mouth-parts fitted for biting; abdomen broadly joined to thorax; feet never bladder-shaped..... 3
   Mouth-parts fitted for sucking, sometimes in part for biting. In latter case, either the base of abdomen is usually strongly constricted and joined to thorax by a narrow peduncle, or the tarsi are bladder-shaped without claws 14
3. Rear end of abdomen without prominent unjointed appendages resembling forceps 4
   Rear end of abdomen with prominent appendages resembling forceps; fore wings, when present, short, veinless, horny or leathery.....**EUPLEXOPTERA**
4. Fore wings not membranous..... 5
   Fore wings, if present, membranous like rear wings; latter occasionally, but not usually, folded like a fan 6
5. Fore wings, if present, leathery, usually with many veins, and thicker than the rear wings, which are folded lengthwise like a fan. If wings are absent, labium is cleft in middle and prothorax is large **ORTHOPTERA**
   Fore wings, if present, veinless, horny or leathery; if absent, labium is entire.....**COLEOPTERA**
6. Antennæ inconspicuous 7
   Antennæ conspicuous 8
7. Rear wings smaller than fore wings; posterior end of abdomen with two or three many-jointed filaments **EPHEMERIDA**

Rear wings as large as fore wings; posterior end of abdomen lacking many-jointed filaments....ODONATA

8. Tarsi with less than five joints; labium cleft in middle 9
Tarsi with five joints; labium entire..... 12

9. Rear wings not broader than fore wings, sometimes absent, not folded in repose; prothorax small, collar-like 10
Rear wings broader than fore wings; both pairs present, folded in repose; prothorax large, nearly flat on dorsal surface .....PLECOPTERA

10. Tarsi with less than four joints..... 11
Tarsi with four joints; wings, when present, equal in size .....ISOPTERA

11. Tarsi with one or two joints; always wingless.....
MALLOPHAGA
Tarsi usually three-jointed, occasionally two-jointed, in which case wings are present; fore wings larger than rear wings .....CORRODENTIA

12. Wings naked or slightly hairy..... 13
Wings thickly covered with hairs.....TRICHOPTERA

13. Mouth-parts not prolonged into a distinct beak, at most slightly conical .....NEUROPTERA
Mouth-parts prolonged into a distinct beak MECOPTERA

14. Prothorax free, body and wings not densely clothed with scales 15
Prothorax not free; maxillary palpi present, sometimes rudimentary and obscure, in which case body and wings are densely clothed with scales; tarsi usually with claws, and never bladder-shaped..... 16

15. Tarsi bladder-shaped, without claws; wings four (sometimes absent), narrow, fringed with long hairs.....
THYSANOPTERA
Tarsi not bladder-shaped, usually with claws; wings not fringed with long hairs; maxillæ bristle-like, without palpi ..... HEMIPTERA

16. Mandibles often rudimentary, and bristle-like when present 17
Mandibles well developed, fitted for biting; wings four (sometimes two or none), naked or with scattered hairs .....HYMENOPTERA

17. Wings two (or wanting). Rear wings represented by halteres; wings and body naked or covered with scattered hairs; mouth a soft or horny beak not coiled under head..... 18

Wings four (sometimes wanting in females). Wings and body covered thickly with scales or hairs; mouth, when developed, a slender sucking proboscis coiled under the head.....**LEPIDOPTERA**

18. Prothorax poorly developed, scarcely visible from dorsal side. Usually two wings.....**DIPTERA**

Prothorax well developed, distinctly visible from dorsal side; wings never present.....**SIPHONAPTERA**

The following arrangement of the orders is in the main that of Comstock, modified in the Neuropteroid groups by Banks, and runs from the lowest to the highest forms. This sequence could not be carried out exactly in the key, but should be followed in the arrangement of insect collections. The principal orders are illustrated by typical examples in Plates III-V.

THYSANURA. Spring-tails, bristle-tails, and fish moths. A small order, and the insects are mostly of small size, inhabiting moist, decaying vegetable matter.

ODONATA. Dragon-flies and damsel-flies. Plate III. A small or medium-sized order, containing some species of large size. All are aquatic in their larval stages, and feed in both larval and adult stages upon other insects, especially mosquitoes.

EUPLEXOPTERA. Earwigs. Plate VII. This order contains only the earwigs, and there are but few species. Many writers treat it as part of the *Orthoptera,* though it differs structurally.

ORTHOPTERA. Grasshoppers, crickets, walking-sticks, mantids, and cockroaches. Plates III, VI-XI. This order does not contain a great number of species, but some of them are of large size and therefore noticeable. Nearly all (except the mantids and the crickets) feed upon vegetable food, and some species are very injurious.

THYSANOPTERA (or **PHYSOPODA**). Includes only the family *Thripidæ*. A small order of small-sized individuals, mostly inhabiting flowers. A few species are injurious.

HEMIPTERA. Lice, aphids, bugs, scale-insects, leaf-hoppers, tree-hoppers, psyllids, cicadas, and other sucking insects. Plate III. This large and important order contains many species and individuals. It is divided by some authors into three orders, namely, the **HOMOPTERA**, including cicadas, leaf-hoppers, aphids, and scale-insects; the **HETEROPTERA**, including the assassin-bugs, leaf bugs, bed-bugs, and related forms; the **PARASITICA**, including the lice which are parasitic upon man and the higher animals. There are a great many species among the Hemiptera which are regarded as injurious.

ISOPTERA. Termites or white ants. A small order, including a single family of social insects. Some species are very destructive, tunneling in trees, construction timbers, etc.

MALLOPHAGA. Biting bird-lice. A small order of small wingless parasitic insects, having incomplete metamorphoses. The species infest fowls and wild birds.

CORRODENTIA. Book-lice. A small order of small-sized insects which feed upon paper, lichens, etc.; not of much economic importance.

PLECOPTERA. Stone-flies. A small order, including a single family, of little economic importance. Larvæ aquatic, serving as food for fishes.

EPHEMERIDA. May-flies or Day-flies. This order contains only a single family of insects, of which there are few species, but many individuals, found near lakes and rivers. Not important economically.

NEUROPTERA. Dobsons, ant-lions, lace-wings, etc. Plate III. A rather small group of insects with transparent membranous wings. Some species, like the dobson, are of large size.

MECOPTERA. Scorpion-flies. A small but remarkable group of insects, with the head prolonged into a beak. So far as known, these insects are carnivorous.

TRICHOPTERA. Caddis-flies. A small but interesting order of moth-like insects. The adults have parchment-like wings, which are more or less hairy and folded against the sides

of the abdomen. The larvæ are aquatic, and make peculiar cases in which they live in the water.

LEPIDOPTERA. Moths and butterflies. Plate IV. A large and important order, including some of the largest and most beautiful of all insects. The wings are covered with scales. Many species are pests of vegetation, but many others are useful in carrying pollen from flower to flower.

DIPTERA. Flies and mosquitoes. Plate V. The insects of this large order have but two wings, which are usually transparent. There are many species, and some of them are very abundant. This order furnishes a number of important pests, and is probably more dangerous to man, on account of some of its members transmitting disease germs, than any other order of insects.

SIPHONAPTERA. Fleas. A small order of small-sized wingless insects, usually considered as an off-shoot from the *Diptera,* though sometimes included as a part of that order. Fleas annoy man and the domestic animals, and recently have been found to be important agents in transmitting the germs of bubonic plague.

COLEOPTERA. Beetles. Plate V. One of the largest and most important orders of insects, easily recognized on account of the horny wing covers. Some species are found in almost every kind of habitat. Many are distinctly injurious, though the predaceous forms, like ground beetles, are regarded as beneficial. In size, beetles vary from microscopic to nearly three inches in length. About 12,000 species are known in North America.

HYMENOPTERA. Bees, wasps, ants, saw-flies, horntails, and ichneumon flies. Plate V. A large and important order, commonly regarded as the most highly developed of all insects. Some groups, like the bees, ants, and certain wasps, are social in their habits. Most of the *Hymenoptera* are beneficial. The honey bee gives us honey and wax, and the ichneumon flies parasitize many injurious species. The honey bees and their near relatives play an important part in the pollination of plants, and the orchardist owes his fruit crop to the agency of this group of insects.

PART II

Euplexoptera (Earwigs) and Orthoptera (Grasshoppers, Crickets, etc.), of Connecticut

BY

BENJAMIN HOVEY WALDEN.

The Euplexoptera and Orthoptera of Connecticut

INTRODUCTION.

The insects discussed in this paper belong to two orders, the *Euplexoptera* and the *Orthoptera,* following the classification adopted for the collection of the Connecticut Agricultural Experiment Station. This collection contains Connecticut representatives of eighty-two species, from which many of the records in this paper are taken. Some writers recognize but one order, and include the small group *Euplexoptera* under *Orthoptera.*

In 1872, Professor Sidney I. Smith of Yale University, who was at that time entomologist of the State Board of Agriculture, presented to the Board a report on the Orthoptera of Connecticut. This paper mentions sixty-one species, of which a few are varieties or synonyms. Probably the most careful collecting in Connecticut in the *Acrididæ,* one family of this order, has been done by Professor Albert P. Morse of Wellesley, Massachusetts, a leading authority on the group. In his "Notes on the Acrididæ of New England" he records all of the species of this family taken by him. In the "Catalogue of the Orthoptera of New England," by Professor Samuel H. Scudder, are recorded seventy-four species as probably occurring in Connecticut. These records were probably largely furnished by Professors Morse and Smith.

The present paper includes one hundred and nine species, one hundred of which have been recorded from the state. The remaining nine species and probably a few others will undoubtedly be found by careful collecting. The arrangement of the genera and species is in general based upon the "Catalogue of the Orthoptera of the United States and Canada," by Scudder.

In the preparation of the keys and descriptions free use has been made of various works on the Orthoptera, especially the "Acrididæ of New England," by Professor Morse, and the "Orthoptera of Indiana," by Professor W. S. Blatchley.

ACKNOWLEDGMENTS.

The writer is greatly indebted to Dr. Britton for much help and many suggestions throughout the preparation of this paper.

Professor A. P. Morse has examined the material in the Station collection, the records in this paper being based largely upon his determinations. Professor Morse's kindness in examining material, loaning specimens for study, and answering questions pertaining to the group, has been greatly appreciated.

Thanks are due to Professor A. E. Verrill of Yale University, through whose kindness we were able to examine the *Orthoptera* stored in the attic of Peabody Museum; to Professor W. S. Blatchley and to Mr. Wm. Beutenmüller for records of *Orthoptera* taken by them in Connecticut.

The measurements are given in millimeters, and refer to the length unless otherwise stated; thus the word "body" with "19-25" under it means that the body from the front of the head to the tip of the abdomen is from 19 to 25 millimeters in length. The measurements of the *Acrididæ* are from Morse's papers, as his figures under many of the species are based upon the careful measurements of several hundred specimens.

The keys apply to Connecticut species only, and are for distinguishing the adults and not the nymphs.

All figures of insects in Plates VI-XI are natural size. Figure 2, of Plate VI, is from the Report of the Connecticut Agricultural Experiment Station for 1903. Figure 3 is from a photograph kindly loaned by Professor M. V. Slingerland of Cornell University. Figures 1 and 4, of the same plate, and the remainder of the plates are from photographs by the author.

Figures 5-15, 17-26, 28-35, 37-48, in the text, are redrawn from Morse. Figures 49-52 are redrawn from Scudder. Figure 61 is from a drawing by W. E. Britton. All others are from drawings by the author.

EXPLANATION OF COLLECTORS' INITIALS.

W. B. — William Beutenmüller, New York. Curator of Entomology, American Museum of Natural History. Has collected *Orthoptera* in Connecticut.

W. E. B. — W. E. Britton, New Haven, State Entomologist and Entomologist of the Connecticut Agricultural Experiment Station. The author of a number of papers on Connecticut insects. Has collected in nearly all parts of the state.

W. S. B. — W. S. Blatchley, Indianapolis, Ind. A leading specialist in the *Orthoptera*. Has collected in Connecticut.

A. P. M. — Albert P. Morse, Wellesley, Mass. Curator of Museum at Wellesley College, and Research Assistant, Carnegie Institute of Washington. A well-known specialist, who has collected *Acrididæ* in the principal sections of the state. The records of his captures are given in "Notes on the Acrididæ of New England," published in *Psyche*.

E. J. S. M. — E. J. S. Moore, New Haven, a student employed temporarily as assistant in the entomological department of the Connecticut Agricultural Experiment Station. Collected chiefly around New Haven.

S. I. S. — Sydney I. Smith, New Haven, Professor of Comparative Anatomy, Yale University. An early student of the *Orthoptera*.

A. E. V. — Addison E. Verrill, New Haven, Professor of Zoölogy, Yale University. Has collected insects in various parts of the state, but chiefly around New Haven and on the Thimble Islands.

H. L. V. — Henry L. Viereck, Philadelphia, for more than a year Assistant in Entomology at the Connecticut Agricultural Experiment Station. Has collected in nearly all sections of the state, but more especially around New Haven and along the shore.

B. H. W. — B. H. Walden, New Haven, Assistant in Entomology at the Connecticut Agricultural Experiment Station. Has collected in nearly all parts of the state.

EUPLEXOPTERA.

The members of this order, commonly called "earwigs," are recognized by their slender, flattened bodies, legs of nearly equal size, and abdomen terminating with a pair of forceps-like appendages.

Head prominent, flattened, and wider than the thorax, with mouth-parts in front. Thorax small. Tegmina or wing covers meeting in a straight line down the back and covering only part of the abdomen; leathery in texture and without veins. Wings large in proportion to the size of the insect; folded lengthwise like a fan and then again crosswise, and thus concealed under the comparatively small wing covers. It is stated that the insects use the above-mentioned forceps in tucking the wings under the covers. The tegmina and wings are both absent in one of our species. The metamorphosis is incomplete.

These insects are much more plentiful in Europe, where they received the name "earwig" from a foolish superstition that they sometimes get into people's ears and injure them. Earwigs are not common in Connecticut, and are seldom seen, as they live in cracks and crannies, beneath stones, bark of stumps, etc., coming out only at night. They are largely vegetable feeders, but eat dead insects and small sluggish forms of animal life. The order includes only a single family.

FORFICULIDÆ.

The members of this family will be recognized by the above description. Two species belonging to different genera have been taken in Connecticut. Other members of this family will probably be found when carefully looked for. A third genus, which should be represented in this state, is added to the following key.

Key to Genera.

1. Tegmina and wings present..... 2
   Tegmina and wings both absent.....**Anisolabis** p. 45
2. Joints of antennæ cylindrical, more than four times as long as broad. Second tarsal joint broadened at apex, bilobed, and produced beneath the third
   Forficula p. 45

Joints of the antennæ cone-shaped, wider at apex than at base. Second tarsal joint very small, simple, and compressed ..... **Labia** p. 46

Anisolabis Fieber.

Body long and slender, sides nearly parallel throughout. Tegmina and wings absent. Antennæ about one-half the length of the body. First and third tarsal joints sub-equal, second joint smaller. Forceps stout and slightly curved.

A. maritima Bonnel. Plate VII, 1.

Dark mahogany brown above, lighter below; legs yellowish brown.

Measurements.		
Length	Width	Forceps
15-22	3-4	3-4

Occurs along the coast from Maine to Florida. Outer Island, Branford (A. E. V.); Bridgeport (F. Knab); Milford, 30 May (B. H. W.).

Forficula Linnæus.

Body somewhat flattened, generally long and slender, sides of abdomen parallel, antennæ a trifle longer than half the length of body, with ten to fifteen cylindrical and nearly equal joints, which are more than four times as long as broad. Wing covers present, wings sometimes present. First joint of tarsi longer than the third; second short, broadened at apex, and extending beneath the third joint.

Key to Species.

1. Wings reaching beyond the tips of the tegmina..... 2
   Wings wanting or much shorter than the tegmina **aculeata**
2. Middle legs much nearer the fore than the hind legs. Forceps of male with an inner tooth at the arcuate portion ..... **auricularia**
   Middle legs but little nearer the fore than the hind legs. Forceps of male with basal tooth on inner edge. . **pulchella**

F. aculeata Scudder.

"Dark chestnut brown; palpi and legs luteous; thorax longer than broad and narrower than the head, the sides pale luteous;

wing covers nearly twice as long as the thorax, luteous, and broadly margined inwardly with deep chestnut brown; hind wings considerably shorter than the wing covers; male forceps about three-fourths as long as the abdomen, slender, arcuate, bent downward beyond the middle and again horizontal to the tip, before which is also a short tooth; pygidium with a long sharp point. Length of body, male and female, 9-11 mm.; forceps of male, 4-5 mm.; female, 2.5-3.5 mm."*

Northern United States east of Mississippi River. Has not been taken in Connecticut.

F. auricularia Linnæus.

"Fusco-ferruginous; antennæ 14-15 jointed; basal joint, sides of thorax and legs testaceous; wings and wing covers dull luteous, the latter half as long again as the pronotum; forceps of male usually as long as the abdomen, horizontal, depressed, and dilated at the base, and beyond rather strongly arcuate, tapering to a point, the extreme base of inner edge tuberculate-denticulate, with a distinct inner tooth at base of the arcuate portion. Body about 11 mm.; forceps, male, 4-8 mm.; female, 3 mm."*

New York, New Jersey. Probably occurs in Connecticut.

F. pulchella Serville.

"Head blackish; antennæ brown, paler at base; thorax brown, with the sides and hind margin paler; wing covers brown; wings yellow edged with brown; abdomen reddish brown; forceps of male arcuate in the middle, pointed, with an inner tooth near the base. Length of body, 8 mm.; forceps of male, 5 mm.; female, 2.5 mm." *

Has been taken in New York.

Labia Leach.

"Size, small. Body flattened and slightly widened at the middle. Antennæ about one-half the length of the body, with ten to twelve joints which are about three times as long as broad. Tegmina present. Wings sometimes absent, but present

* Descriptive Catalogue of the Orthoptera found within fifty miles of New York City. Beutenmüller.

in our species. First and third tarsal joints equal in length, second joint small, simple and compressed. Forceps about half the length of the abdomen, separated at the base in the male, not separated in the female." *

L. minor Linnæus. Little Earwig.

"Much smaller than any of the preceding species. Light brown, pubescent; head blackish; antennæ 10-12-jointed, fuscous; mouth-parts pale; pronotum narrower than the head, and a little longer than broad; wing covers nearly twice as long as the thorax; hind wings as long as the pronotum; legs pale luteous; abdomen reddish brown in the middle above; forceps of male more than half as long as the abdomen, and distinctly serrulate on inner edge; last segment of male with an apical, compressed, upcurved, long and slender tubercle. Length of body, 3.75-6 mm.; forceps, 1.25-2 mm."*

Meriden, 3 June (W. E. B.); Lyme, 23 August (A. B. Champlain); Berlin, 28 September (D. J. Caffrey).

* Descriptive Catalogue of the Orthoptera found within fifty miles of New York City. Beutenmüller.

ORTHOPTERA.

The insects in the order *Orthoptera* with which we are all familiar are the grasshoppers or locusts, katydids, crickets, and cockroaches. The order also contains the walking-sticks, which are rarely seen, and the mantids, two species of which have but recently been introduced into Connecticut.

The *Orthoptera* belong to the group of insects having an incomplete metamorphosis and biting mouth-parts. The wings, when present, are four in number. The outer pair, or tegmina, as they are called, are not used for flight, but are thick and

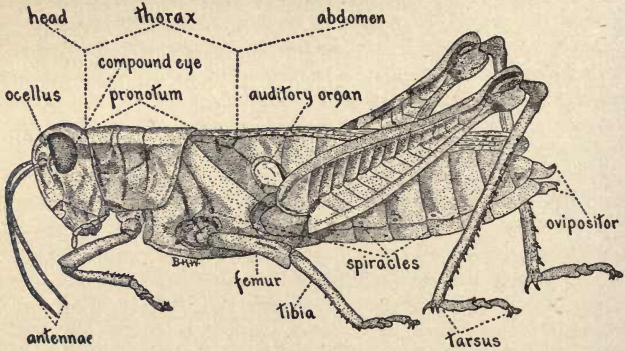


FIG. 4. *Melanoplus bivittatus.* Diagram showing principal parts of a locust.

leathery in texture and serve as covers for the under wings. When closed, their inner edges usually overlap. The second pair of wings are the ones with which the insects fly, and are thin, delicate, and folded lengthwise like a fan. The name *Orthoptera* is from the Greek words *orthos,* straight, and *pteron,* a wing, referring to the longitudinal straight folds of the hind wings. The wings of some species of *Orthoptera* are absent while other species have only the tegmina present.

ECONOMIC IMPORTANCE OF THE ORDER.

The *Orthoptera* are of great economic importance, as all of them, with the exception of the *Mantidæ,* are injurious, and nearly all feed upon vegetation. From the earliest Bible times

the locusts (*Acrididæ*) have been recorded as doing great damage to agricultural crops. Certain migratory species would pass in great numbers over a portion of the country destroying all the cultivated crops and even defoliating the shrubbery and trees. It is within the memory of many when the Rocky Mountain locust caused millions of dollars' worth of damage in the west. Even New England, in her early days, did not escape the ravages of an allied species, *Melanoplus atlanis*.* Smith in his report to the Board of Agriculture states, "In 1743 and 1756 they threatened to destroy the whole vegetation in some parts of the country, and so great was the alarm they occasioned among the people, that days of fasting and prayer were appointed on account of the threatened calamity." While no such invasion is likely to occur in these days, much damage is done each year by these insects. This will be impressed upon any one who walks through the meadows and fields at any time from July until frost, and notes the members of this order that are hopping around on every side; and the possible damage that may be done will be appreciated when one remembers that each of these little insects is "born with one earthly desire — a voracious appetite — and with one valuable possession — a pair of strong, broad jaws, which move in and out like the blades of a pair of scissors; the little hopper soon begins to use the latter to appease the former, and for twenty-four hours a day and seven days a week, he gnaws away at the soft, green, succulent grass which surrounds him on every side."

Numerous as the *Orthoptera* are, very little attention is paid to them by the farmers of the state. It would be difficult to estimate the damage to mowing-lands and pastures from these insects; and, while the yield must be considerably reduced each year, their work probably escapes unnoticed excepting in very dry seasons, when the conditions are the most unfavorable for the growth of the grass and most favorable for the development of the *Orthoptera*.

In 1872, Professor Sidney I. Smith recommended a flock of poultry, especially turkeys, as one of the best means of destroying grasshoppers. Probably there is nothing better to

* This species is mentioned by Smith as being *M. femur-rubrum*, but it was probably *atlanis*, as the migratory habit is peculiar to the latter species.

suggest at this time for reducing their numbers, and, judging from market prices, the turkeys could be disposed of at a fair profit.

The eggs of the *Acrididæ* are readily killed by plowing the land in which they are deposited in the fall. Possibly the most apparent damage by the *Orthoptera* is in the tobacco fields. The writer has seen strips around the edges of fields where the leaves were badly eaten. This is more liable to occur where the fields are bordered by wild vegetation than where the tobacco adjoins cultivated fields or where the edges are kept clean. Species of *Scudderia,* the Carolina locust (*Dissosteira carolina*), and the red-legged locust (*Melanoplus femur-rubrum*), have been observed in the center of fields; but species of *Xiphidium* and the majority of the individuals of the above-named species work principally on the edges of the fields. Clean cultivation, or poisoning the native growth and the tobacco around the edge of the field, will prevent much of this damage.

The cranberry crop is often damaged considerably by katydids. Professor J. B. Smith of New Jersey has studied these insects on the bogs, and finds that two species, *Scudderia texensis* and *S. curvicauda,* cause much of the damage. These insects eat into the berries to get the seeds, after which the berries dry up.

Clean culture on the bogs and around the margins, keeping the bogs flooded as much as possible, especially late in spring, and burning the bogs to destroy the leaves in which the *Scudderia* eggs are laid, are the methods of treatment recommended.

NATURAL ENEMIES.

The *Orthoptera* have many natural enemies which greatly reduce their numbers, and prevent them from over-running our farms and destroying everything that grows.

One of the important parasites is a fungus, *Empusa grylli* Fres. This is especially common in a wet season. Locusts attacked by this fungus climb the stems of grasses and weeds, where their dead bodies are seen late in the season. This peculiar habit is an important aid in the distribution of the disease, as from this elevated position the spores of the fungus may be

blown over a considerable area. The *Orthoptera* are also attacked by bacterial diseases, especially during long warm damp periods.

A great many locusts are attacked and killed by a red mite, *Trombidium locustarum* Riley. This is often seen clinging to the body of the locust, where it sucks out the vital juices. These mites are often very numerous, one female sometimes producing three hundred or more eggs. The winter is passed in the ground, where they are active except during freezing weather. They feed upon a variety of soft substances, and are especially fond of locust eggs.

Another animal parasite that attacks various species of *Orthoptera* is a "hair worm," a species of *Gordius*.

The group also has a large number of insect enemies, among which are tachina flies, flesh flies, larvæ of blister beetles, and carabid beetles. Toads, moles, shrews, and snakes feed upon one or all stages of *Orthoptera*.

Many species of birds include the insects of this order in their diet. The average person has very little idea of the variety of birds that feed upon insects, or the number of insects that some of these birds eat. Many of the insect-eating birds feed largely upon *Orthoptera*.

ORTHOPTERA.

Key to Sub-orders.

Legs nearly equal in size. Hind femora not enlarged for leaping. Sound-producing organs absent. Ovipositor concealed ..... NON-SALTATORIA p. 52

Legs unequal in size. Hind femora enlarged and thickened for leaping, generally much longer than the middle femora. Sound-producing organs usually present. Ovipositor usually plainly visible....SALTATORIA p. 62

NON-SALTATORIA.

The insects of this sub-order have the legs fitted for running rather than for leaping. There are three families (not including *Forficulidæ*) in this group in the United States, all of which are represented in Connecticut,* and may be distinguished by the following key:

Key to Families.

1. Body short, broad, oval, and strongly flattened. Head nearly concealed by pronotum. Ocelli two. Pronotum shield-shaped, transverse. Legs compressed BLATTIDÆ p. 52

   Body elongate, narrow. Head free, not covered by pronotum which is much longer than broad. Ocelli three or wanting. Legs slender, not compressed.... 2

2. Head oblique, mouth inferior. Ocelli three. Pronotum generally longer than any other segment. Front pair of legs fitted for grasping. Cerci jointed..... MANTIDÆ p. 59

   Head sub-horizontal, mouth-parts nearly inferior. Ocelli often wanting. Pronotum very short. Front pair of legs not fitted for grasping. Cerci not jointed ..... PHASMIDÆ p. 61

BLATTIDÆ.

This family includes the insects known as cockroaches. The body is oval and much flattened, head nearly horizontal, almost covered by the broad pronotum, and bent under so that the mouth-parts project back between the front pair of legs. The

* The family *Mantidæ* is represented in Connecticut only by introduced species.

antennæ are long and slender. The pronotum is usually broader than long, or shield-shape. The rings of the abdomen overlap each other and are capable of being much depressed, so that these insects can readily adapt themselves to the cracks and narrow places in which they live. The legs are long, enabling the cockroach to run very swiftly. The wing covers contain many veins and are parchment-like or leathery, overlapping when at rest. The wings are never longer than the tegmina and are rudimentary or even wanting in some species.

Everyone is more or less familiar with the cockroach or water-bug. Our troublesome species are introduced and infest dwellings, delighting to live in the cracks and crevices in warm damp places, such as are found around steam and water pipes, back of sinks, etc. These insects are nocturnal in habit, coming out at night and feeding upon a great variety of substances, including all kinds of provisions, clothes that are starched, and book bindings. In Connecticut we have taken three species that commonly inhabit houses. Besides these there are probably several native species that live under the loose bark of trees and rubbish. Of these, however, only two species have been taken.

Some of the tropical species are occasionally brought into the state with fruit, especially bananas. Specimens of a large brown species, probably *Nyctobora mexicana* Sauss., have been seen by the writer, and a specimen of a large, handsome green species, *Panchlora poeyi Sauss.,* has been taken by Dr. Britton on bananas in New Haven. *Leucophaea surinamensis* Linn. has been very abundant for several years in greenhouses at Cromwell.

Key to Sub-families.

Last ventral segment of the female plane, without a ridge, and undivided. Fore femora rarely armed beneath on the inner margin with many distinct spines; when so armed, the subgenital styles unequal or one wanting ..... BLATTELLINÆ p. 54

Last ventral segment of the female abdomen compressed so that a ridge or carina is formed on its under side, and divided so as to be bivalved. Fore femora armed beneath on the inner margin with many spines; styles of equal length..... PERIPLANETINÆ p. 57

BLATTELLINÆ.

Key to Genera.

Size large. Sub-genital stylets present in the males. Tegmina of females abbreviated, not reaching more than two-thirds the length of the broad abdomen **Ischnoptera** p. 54

Size small. Sub-genital stylets absent in the males. Tegmina of both sexes fully developed..... **Blattella** p. 56

Ischnoptera Burmeister.

Body of male narrow and elongate, sides sub-parallel, female with body wider and more rounded. Antennæ much longer than the body. Pronotum rounded, usually narrowed in front. Tegmina longer than the abdomen in the males, much shorter (in our species) in the females. Wings present. "Cerci long, stout, 12-jointed, supra-anal plate of the male broad, apex either truncated or rounded, that of the female narrower, triangular, and obtuse. Sub-genital plate of the male bearing two rather long stylets which are often deflexed. Last abdominal plate of the female entire." This genus contains our two native species.

*Key to Species.**

Size large, total length 25 or more mm. Margin of pronotum much lighter than disk ..... **pennsylvanica**

Size smaller, total length less than 20 mm. Pronotum more uniform in color..... **uhleriana**

I. **pennsylvanica** De Geer. Pennsylvania Cockroach. Plate VII, 2.

Male: pronotum elliptical, slightly narrowed in front with the margin straight. Posterior margin rounded. The disk with an oblique posterior depression on either side. Tegmina long and narrow extending much beyond the tip of the abdomen, membranous and more or less transparent. Wings as long as the tegmina. Female with the abdomen wider than the pronotum, the width more than one-half its length. Pronotum wide with the front margin narrowed and rounded, the posterior margin narrowed truncate. Disk with no oblique depressions. Tegmina broad, their inner margins overlapping, covering from one-half to two-thirds the abdomen, the tips rounded, and the veins

* See note page 162.

prominent. Inner wings narrow, about half the length of the abdomen. Color chestnut-brown to fuscous, females the darker. Face reddish brown. Disk of pronotum with the lateral edges and sometimes the front yellowish white. Tegmina of male smoky brown, the outer basal two-thirds broadly margined with yellow. Those of female dark reddish brown with the outer basal half margined with yellow. Dorsal surface of female abdomen dark brown.

Measurements.

	Body	Antennæ	Pronotum		Tegmina
			Length	Width	
Female	16	18	5	7.	6-10
Male	21	28	5	5.5	22

This species, found under the bark of stumps, or under stones and rubbish, is not usually common, but is sometimes attracted to country houses by light, where it may become a nuisance. Mt. Carmel, 18 June (E. F. Coe); 10 July (W. E. B.).

I. uhleriana Saussure.

Male: small; body narrow. Antennæ slightly longer than the body. Pronotum small, elliptical; hind margin rounded; sides somewhat deflexed, the oblique depressions distinct. Tegmina longer than abdomen, rather wide. Wings reaching tips of tegmina; supra-anal plate triangular. Female: body wider than that of the male. Pronotum rounded with the hind margin nearly straight. Tegmina covering less than half the abdomen, the inner margins meeting or slightly overlapping, the tips rounded, usually slightly emarginate near the inner angle. Disk somewhat convex. Depressions faint. Wings narrow and reaching only to second abdominal segment. Supra-anal plate triangular. Color of male light reddish brown; head and posterior margin of pronotum often darker. Female darker; general color dark reddish brown; tegmina sometimes chestnut brown. Dorsal surface of abdomen brown to piceous; legs pale reddish brown.

Measurements.

	Body	Pronotum		Tegmina
		Length	Width	
Female	11	3.3	3.7	3.7
Male	12	3	4	16

Occurs in the same places as *pennsylvanica*. Stonington, 25 June — 5 July (J. A. Hyslop); New Haven, 19 April (B. H. W.); 10 July (W. E. B.); Wallingford, 19 June (D. J. Caffrey).

Blattella Caudell.

Our single species of *Blattella* is much smaller than the insects of the preceding genus. Body long and narrow; pronotum small and roundish, almost completely covering the head. Eyes large. Antennæ much longer than the body and thinly covered with long hairs. Tegmina membranous or a little leathery and as long or longer than the abdomen in both sexes. Sub-anal plate of male with the styles rudimentary or wanting. Last abdominal segment of female not notched.

B. germanica Linn. Croton-bug. Water-bug. German Cockroach. Plate VII, 3.

Color yellowish brown; the females, as in most species, often darker than the males. Legs lighter in color. Pronotum marked longitudinally with two dark brown bands separated by a stripe of yellow. Antennæ dark brown, exceeding slightly the tips of the tegmina, which reach to the end of abdomen (male) or somewhat pass it (female). The body of the female is shorter and broader than that of the male.

Measurements.

	Body	Antennæ	Pronotum		Tegmina
			Length	Width	
Female	10	13	8.	4.	11
Male	13	14	2.5	3.25	9-10

This is an introduced species and is commonly known as the croton-bug from the fact that the species became numerous in New York at the time of the completion of the Croton aqueduct. The insects made their way along the pipes, entering houses connected with this system. It is probably the most abundant cockroach in Connecticut. While it is not so often met with in the country, it is quite common in cities, and, as it is not partial to filth, it is liable to infest any dwelling, especially one heated with steam, and may become the plague of the most careful housekeeper. It is usually confined to the kitchen and pantry where food is found in abundance. The most effective

remedy against this insect is to fumigate the infested rooms with hydrocyanic acid gas. This gas is fatal to all animal life, so that its use is only practicable where the kitchen is isolated from the other part of the house, or where it can be shut up tightly. Carbon disulphide has been recommended, but this is quite inflammable and has a disagreeable odor. Borax and pyrethrum (insect powder) are often used as repellents. Burning the pyrethrum powder will kill and stupefy many of the insects.

PERIPLANETINÆ.

This sub-family contains our largest cockroaches. These are introduced species; and one of them, the most disgusting of all our roaches, is well known. The chief distinguishing characters are given in the key. The head is large, flattened, and not entirely covered by the pronotum. The antennæ are more or less pubescent, the joints obconic and very short. The tegmina and wings are variable in the different species. In our species the hind tarsi have the first joint as long as, or longer than, the other two joints together.

Key to Genera.

Tegmina of the male covering about three-fourths of the abdomen, those of the female much shorter. Distance between the eyes greater than length of last joint of maxillary palpus ..... **Blatta** p. 57

Tegmina of both sexes extending beyond tip of abdomen. Distance between the eyes less than length of last joint of maxillary palpus..... **Periplaneta** p. 58

Blatta Linnæus.

This genus is recognized by the more widely separated eyes which are farther apart than the distance between the antennal pits or scrobes. The tegmina are short in both sexes, especially so in the female, and their outer edges less rounded than in *Periplaneta.*

B. orientalis Linnæus. Oriental Cockroach. Black Beetle. Plate VII, 4.

Dark mahogany brown, legs lighter. Pronotum without light margins or markings. The wing covers of female not over

5 mm. in length and the wings not developed. The tegmina and wings of male well developed, about equal in length, covering about three-fourths of the abdomen. Supra-anal plate of male truncated, that of the female rounded and with a shallow notch.

Measurements.

	Body	Pronotum		Tegmina
		Length	Width	
Female	26	..	8.5	5
Male	22.5	6	7.5	12

The Oriental cockroach is probably found in all the larger towns of the State. Unlike the croton-bug, it seeks dark, damp, filthy places.

Periplaneta Burmeister.

This genus contains our largest cockroaches. The inner wings are as long as the tegmina which extend beyond the tip of the abdomen in both species.

Key to Species.

Tegmina extending much beyond end of abdomen (10-12 mm.). Without light stripe on the outer margin of basal half.....**americana**

Tegmina extending but little beyond end of abdomen (3-5 mm.). A yellow stripe on the outer margin of basal half **australasiæ**

P. americana Linnæus. American Cockroach. Plate VII, 5. General color, reddish brown, the pronotum with a submargin of yellow, which is broad at the rear and sides and narrowed in front; this incloses a brown area more or less bisected by a broken median stripe of yellow. Wings and tegmina long and well developed in both sexes. Notch of supra-anal plate of female deep.

Measurements.

	Body	Pronotum		Tegmina
		Length	Width	
Female	30	..	..	..
Male	27	10	8	30

This large cockroach has been taken in New Haven but is probably much less common throughout the state than *orientalis*.

It is a native of tropical America, but has been distributed around the world. It is said to be much more cleanly in its choice of an abiding place than is *Blatta orientalis*. When numerous it becomes a serious pest.

"The young of the American roach require about a year to reach maturity. The rate of growth of it and other species depends, however, largely on the food and temperature conditions, and under unfavorable circumstances the nymph stage is much prolonged." "The abundance of roaches is, therefore, apparently not accounted for so much by their rapidity of multiplication as by their unusual ability to preserve themselves from ordinary means of destruction and by the scarcity of natural enemies."

P. australasiæ Fabricius. Australian Roach.

This cockroach is slightly smaller and darker colored than the above species. It is readily distinguished by the yellow stripe on the basal half of the outer margin of the tegmina.

	Measurements.			
	Body	Pronotum		Tegmina
		Length	Width	
Female	23	7	9.5	22
Male	..	..	..	..

New Haven, August (D. B. Pangburn); Wallingford, 5 August (D. J. Caffrey).

It will probably be found in most cities, especially those along the coast. The Australian roach is very abundant in the South, where it is a greater pest than either of the other members of this sub-family.

MANTIDÆ.

The large insects of this family will be readily recognized by the long prothorax, and the first pair of legs which are fitted for grasping. The pronotum is the longest segment of the body. Head large, triangular, and so joined to the prothorax that it is freely movable. Antennæ slender, shorter than the body. The abdomen of the male is much more slender than that of the female. The fore legs are very stout, spiny, and terminating in a single claw which, with the five-jointed tarsus, folds into a groove on the under side of the tibia. The other legs are long

and slender. Tegmina and wings are present, those of the female often rudimentary.

The mantids differ from all of the other members of the order in that they are beneficial, feeding largely on other insects. These insects are often called "praying mantids" from the prayerful attitude which they assume with their folded fore legs when at rest or waiting for some insect to come within their reach.

These introduced insects will be readily recognized from the illustrations on plate VI, and are readily distinguished by their relative size.

Tenodera sinensis Saussure. Chinese Mantis. Plate VI, 1.

This large Chinese insect was first brought to our attention by an egg-mass received from a nursery in New Haven. The egg-mass was sent Feb. 1, 1902, and was found upon *Ilex crenata* which had been imported direct from Japan the previous spring. Another egg-mass was found in this nursery during the summer of 1903, indicating that the species had lived through the winter.* An adult female of this species was taken near Philadelphia, October 16, 1897, in the vicinity of large nurseries which imported considerable stock. It soon became thoroughly established, and in 1902 nearly half a barrel of the egg-masses were collected for distribution. A number of egg-masses were brought from Philadelphia to Connecticut in the winter of 1903, but, while a few of these hatched, it is not thought that any reached maturity. The following winter about twenty-five more egg-masses were obtained and distributed in five different localities. About a dozen adult specimens in all were seen in three of these localities the following fall, and in one of these localities a few adults were found the second season. This shows that the insect will live through our winters, but it is doubtful if it has become thoroughly established in the state.

Measurements.

	Body	Tegmina	Pronotum	Fore Femora	Fore Tibiæ	Hind Femora
Male	87	61	23	14	18	26

Mantis religiosa Linnæus. European Praying Mantis. Plate VI, 3.

* See III Report, Conn. State Entomologist, 1903, p. 213.

This is a European species which was found in New York state near Rochester in 1899,* and has since become well established in that vicinity. This was probably also introduced with nursery stock. As this species often lays its egg-mass on the stems of grass, it has been suggested that an egg-mass might have been in the hay which is often used for packing when shipping nursery stock. Egg-masses of this species were obtained in 1903, and brought to Connecticut, but they failed to hatch.

PHASMIDÆ.

This family contains the insects known as "walking-sticks." The body is very long and nearly cylindrical. The head is not covered by the pronotum. The eyes are small, the ocelli often wanting. Tegmina and wings are wanting in the species of the United States. The legs are long and slender, nearly equal in size. The tarsi are usually five-jointed and terminate with claws.

The *Phasmidæ* are best represented in the tropics where forms are found with large wings, one species especially being remarkable for its close resemblance to a leaf. The species of the United States, which are confined largely to the southern states, are wingless and mimic the twigs on which they feed. Despite the fact that these insects are very slender and have long legs, they are awkward and sluggish in their movements, and depend largely upon their protective resemblance to escape detection. The eggs of these insects are dropped singly upon the ground in the fall, where they remain unprotected through the winter. These usually hatch irregularly through the first season, and it is stated that some may not hatch until the second season.

Diapheromera Gray.

Head smooth, oval or sub-quadrate, and obliquely attached to the thorax. Antennæ exceeding twice the length of the anterior femora. The first segment of the thorax less than one-fourth the length of the second and third, which are about equal in length. Body long, slender, and cylindrical, "stick-like," that of the male terminating in cylindrical, incurved cerci, longer than the last abdominal segment. Legs very slender, the

* Cornell University Experiment Station, Bull. 185, 1900.

middle femora of the male much swollen, and with a sharp spine at the apex of the under side of both the middle and hind femora, which is less prominent in the female.

One species of this genus occurs throughout the northern United States east of the Rocky Mountains and is represented in Connecticut.

D. femorata Say. Northern Walking-stick. Plate VII, 7.

Color of the male usually greenish brown, sometimes almost entirely green. Head yellowish, with three more or less distinct longitudinal fuscous stripes. The female more often grayish brown, more or less mottled with lighter specks. The male is readily distinguished by the more slender body, the less dilated fore femora, the more swollen middle femora, and the stouter spines near the tips of the middle and hind femora. The middle femora of the darker males are banded with lighter color.

	Measurements.		
	Body	Antennæ	Hind Femora
Female	84	64	18
Male	70	62	18

This curious insect is probably well distributed throughout the state and is sometimes locally abundant, but the ordinary observer will seldom see more than one or two specimens in a year, owing to its protective resemblance to twigs and its habit of remaining quiet for long periods. It is often taken in sweeping low bushes, the hazel apparently being one of its favorite food plants. The northern walking-stick is the most common species in the United States and the only one of economic importance. It has been recorded as defoliating considerable tracts of woodland, oak and wild cherry usually being attacked first. Ordinarily it is not abundant enough to do much damage. Burning the ground in the fall to destroy the eggs is the remedy suggested.

SALTATORIA.

The *Orthoptera* belonging to this sub-order have the hind pair of legs greatly enlarged and fitted for leaping. In the winged forms the males are provided with calling organs, and both sexes possess auditory or hearing organs. The wingless forms lack both the calling and hearing organs. Three families

are included here which contain the majority of our well-known insects of the order *Orthoptera.*

Key to Families.

1. Antennæ much longer than the body, very slender, tapering. Ocelli often wanting, tarsi three- or four-jointed. Hearing organs usually near the base of the fore tibiæ. Ovipositor usually much elongated..... 2

   Antennæ much shorter than the body, ocelli three. Tarsi three-jointed. Hearing organs when present situated on the sides of the basal joint of the abdomen. Ovipositor consisting of two pairs of short, horny plates, more or less curved, with the tips diverging .....ACRIDIDÆ p. 63

2. Tarsi four-jointed. Ocelli generally absent. Tegmina with the sides sloping. Ovipositor usually in the shape of a flattened, sword-shaped blade, the tip not expanded .....LOCUSTIDÆ p. 123

   Tarsi three-jointed. Ocelli variable. Tegmina flattened above, with the sides bent abruptly downward. Ovipositor usually exserted and consisting of a nearly straight or upcurved needle, the tip often enlarged GRYLLIDÆ p. 147

ACRIDIDÆ.

This family contains the short-horned grasshoppers which are properly termed "locusts." In Connecticut they are ordinarily called simply "grasshoppers." Their numbers outrank those of the other families.

The *Acrididæ* are readily distinguished from the other families by the antennæ, which are shorter than the body. They may be filiform, ensiform, or rarely clavate. The joints are distinct and are often flattened towards the base. The head is usually short and extended horizontally. The ocelli are present and three in number. The foveolæ are usually present, their size and shape furnishing characters used in classification. The pronotum is somewhat saddle-shaped, and usually covers the three thoracic segments, though in the *Tettiginæ* it extends back over the abdomen. The tegmina and wings when present and

closed are partly extended horizontally along the top of the abdomen and partly deflected against the sides. The hearing organ when present is situated on the side of the first basal segment of the abdomen. The fore and middle pairs of legs are nearly equal in size. The hind pair are much longer, with the femora greatly enlarged for leaping. The tarsi of all the legs are similar — three-jointed, with a pair of curved claws on the tip of the apical joint. Between these claws, excepting in the *Tettiginæ,* is a small pad called the pulvillus or arolium. The ovipositor consists of four horny plates, one pair curving upward and the other pair curving downward. In the male the lower appendage consists of a single plate.

The males only are furnished with stridulating or sound-producing organs. The sound is produced in two ways. In one group the sound or call is made only when the insects are at rest, and is produced by rubbing the inner surface of the hind femora over the upper surface of the tegmina.

"Landois has shown that in this group the inner surface of the femur is furnished, along the lower margin, with a longitudinal row of minute, lancet-shaped, elastic teeth, ranging in number from 85 to 93, which are scraped across the veins of the tegmina, thus producing a low, buzzing sound. Those which stridulate in this manner mostly belong to the sub-families *Tryxalinæ* and *Acridinæ.*

"The members of the sub-family *Œdipodinæ* usually sound their call during flight by rubbing together the upper surface of the front edge of the wings and the under surface of the tegmina, thus producing a sharp, crackling sound which has been likened to that of burning stubble. By paying close attention the observer can soon learn to know each species by its peculiar call." — Blatchley.

Key to Sub-families.

1. Size large; pronotum not extending over the abdomen; claws of tarsi with pads between them..... 2
   Size smaller; pronotum extending back over the abdomen; claws of tarsi without pads (pulvilli) between them .....TETTIGINÆ p. 65

2. No spine between the front pair of legs..... 3
   A prominent conical spine between the front pair of legs .....ACRIDINÆ p. 106
3. Face usually very oblique; foveolæ usually well developed; median carina of the pronotum never raised in the form of a crest or with more than one notch
   TRYXALINÆ p. 71
   Face or front of the head more vertical and more rounded than above; foveolæ not well developed; median carina of pronotum usually raised in the form of a crest and usually cut by more than one notch
   ŒDIPODINÆ p. 86

TETTIGINÆ.

The Tettiginæ or "grouse locusts," as they are often called, are the smallest members of the *Acrididæ*. At first glance they might be taken for immature grasshoppers, but they can be readily distinguished by the pronotum which extends to or beyond the extremity of the abdomen. The tegmina are only rudimentary and consist of small scales at the base of the wings. The wings are usually large and well developed. No pads are present between the claws of the tarsi.

The grouse locusts are the only members of our *Acrididæ* which pass the winter as adults, hibernating under rubbish, fence rails, pieces of bark, etc. They are, therefore, the first Acridians to appear early in spring, being most numerous at this season and in the fall, though some species can be found nearly every month in the year. The dry, sunny hillsides of a pasture seem to be the favorite haunt of some species, while others prefer moist, boggy land or the margins of lakes and streams. Their color and variable markings harmonize perfectly with the surroundings, making them very inconspicuous. Indeed, it is seldom that they are seen unless one is searching for them.

Key to Genera.

1. Antennæ with 12 to 14 joints..... 2
   Antennæ with 21 or 22 joints.....**Tettigidea** p. 70
2. Median carina high, crest-like, arched longitudinally. Superior lateral sinus of pronotum shallow, about one-half as deep as the inferior (Fig. 6).....
   Nomotettix p. 66

Median carina low, dorsum rather flat. Superior lateral sinus of pronotum nearly as deep as the inferior (Fig. 9) 3

3. Vertex of head projecting beyond eyes (Fig. 8).... **Tettix** p. 67

Vertex of head not projecting beyond eyes (Fig. 11) **Paratettix** p. 69

Nomotettix Morse.

Head with the vertex projecting beyond the eyes and wider than one of them, the front border rounded. Front of vertex when viewed from the side sub-rounded, with a deep notch in front of eyes. Top of head with a pair of nipple-like tubercles between the posterior portion of the eyes. Pronotum with the median carina high, longitudinally arched, and usually extending only to the end of abdomen, with the inner wings rudimentary. Rarely the pronotum is prolonged and the inner wings well developed.

N. cristatus Scudder. Plate VII, 8.

This species is our smallest Acridian and will be readily recognized by the high arched pronotum. The hind femora are

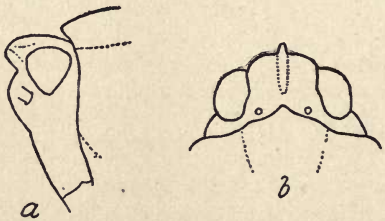


FIG. 5. *Nomotettix cristatus.* Lateral and dorsal views of head.

FIG. 6. *Nomotettix cristatus.* Lateral view, showing crest of pronotum and sinuses of lateral lobes.

FIG. 7. *Nomotettix cristatus.* Cross section of body.

stouter than in the species of *Tettix*. The color may be a uniform grayish brown or the pronotum may be strikingly marked with a design of velvety black. This is the most common of our grouse locusts, and is found all over the state in dry pastures and on hillsides where the soil is light and the vegetation is scant. It can probably be found in every month of the year.

	Measurements.	
	Total length	Pronotum
Female	8.6-10.2	8 -9.5
Male	7.7- 9	7.1-8.5

From various parts of the state from 27 April to 2 October.

N. cristatus, var. **carinatus** Scudder.

In the form *carinatus* the pronotum is prolonged and slightly upturned at the end. The inner wings are also developed.

	Measurements.	
	Total length	Pronotum
Female	11-12.5	9.8-11.5
Male	11-11.5	9.5-10.7

Quite rare; the collection contains two specimens as follows: —West Haven, 11 May, Scotland, May (B. H. W.).

Tettix Charpentier.

This genus has the vertex of head projecting beyond the eyes. Dorsum or top of pronotum flat. Median carina distinct but not prominent. Superior lateral sinus nearly as deep as the inferior. Wing covers in form of oval scales. Wings well developed, usually as long or longer than the abdomen.

Key to Species.

Vertex with front margin rounded, median carina projecting (Fig. 8) ..... **ornatus**

Vertex with front margin angulate, median carina not projecting (Fig. 10) ..... **granulatus**

T. ornatus Say. Plate VII, 9.

This species varies greatly in structure, color, and markings, but can be readily distinguished by the characters given above. A short-winged form was described as *T. triangularis*, but a large series of specimens will usually grade from the typical

form of *ornatus* to the typical *triangularis,* showing that the latter is but an extreme variation.

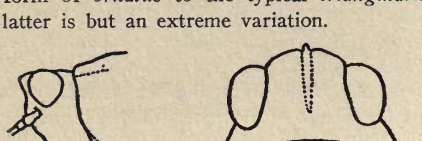


FIG. 8. *Tettix ornatus.* Lateral and dorsal views of head.

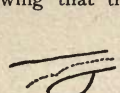


FIG. 9. *Tettix ornatus.* Sinuses of lateral lobes of pronotum.

Measurements.

	Length	Pronotum
Female	9 -13.5	8 -12
Male	8.3-12.5	7.5-11

Rather common in spring and fall. Frequents moist meadows and the more moist portions of uplands. New Haven, 29 August (A. P. M.); Mt. Carmel, 4 November (E. J. S. M.); Woodbridge, 16 April, New Haven, 2, 24 May, Middletown, 22 September, New Canaan, 4 October (W. E. B.); New Haven, 26 April, 17 May, 4 June, 17 August, 10 September, Scotland, 2 September (B. H. W.).

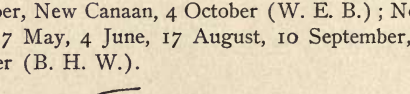


FIG. 10. *Tettix granulatus.* Lateral and dorsal views of head.

T. granulatus Kirby.

Rather more slender and eyes less prominent than in the previous species. Vertex angulate with the median carina very slightly advanced. Pronotum and legs finely granulated.

Measurements.

	Length	Pronotum
Female	13.5-15.3	12 -15-5
Male	9.7-13.5	8.6-11.5

Said to be one of the most common and widely spread species of the group, and found in similar locations to *ornatus.* I have

taken *ornatus* much more frequently. New Haven, 4 June, 20 August, Centerville, 10 May, Lyme, 20 August (B. H. W.).

Paratettix Bolivar.

The members of this genus are distinguished by the short and narrow vertex which is not projected beyond the eyes. Eyes prominent, antennæ with 14 joints. Pronotum with the dorsum flat, front margin truncate. Tegmina in form of oval scales. Wings usually well developed.

P. cucullatus Burmeister. Hooded Grouse Locust.

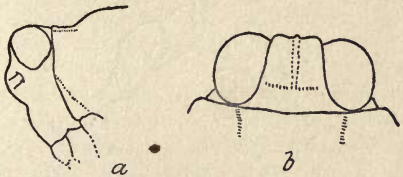


FIG. 11. *Paratettix cucullatus*. Lateral and dorsal views of head.

This species is readily recognized by means of the key and the above description. Color a uniform yellowish to grayish brown. Vertex from above but little wider than one of the eyes, which are large and prominent. Pronotum truncate in front and extending forward to the eyes.

	Measurements.	
	Length	Pronotum
Female	13.5-15.5	11 -13
Male	11 -13.5	9.5-11

This species is very local in its distribution, occurring along the shores of ponds and streams. Canaan, 18 August (1 female), Thompson, 13 July (scarce), August 4-9 (very scarce), New Haven, 27 August (abundant) (A. P. M.); East Hartford, 13 August (1 male) (B. H. W.).

Morse states, "The Thompson and Canaan specimens were found in the sandy mud of a lake shore, and were yellowish-gray; the others on a margin of a little stream strewn with fragments of blackened wood and other waste, and were very dark." The East Hartford specimen was taken near a small

pond in a large excavated area and was of the grayish brown color of the soil.

Tettigidea Scudder.

More robust and clumsy than previous genera. Head larger and face less oblique. Antennæ with 22 joints. The top of the head with a small lobe on either side which projects upon the upper inner border of the eyes. Vertex wider than one of the eyes. Pronotum with the dorsal surface usually finely wrinkled, the sides sloping downward between the shoulders, the rear portion flat.

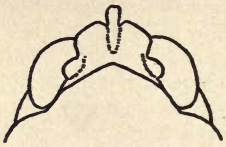


FIG. 12. *Tettigidea parvipennis.* Dorsal view of head.

T. parvipennis Harris. Plate VII, 10.

Grayish or light brown above, sides darker. Male with the lower part of the face and the front portion of the lower part of the sides of the pronotum whitish. The pronotum with the median carina distinct, the posterior portion slightly passing the tip of the abdomen, with the wings abortive, or, in the form *pennata,* passing the tip of the hind femora, and with the wings developed.

Measurements.

	Total length	Pronotum
Female	11.5-14	10.4-13
Male	8.4-11.5	8 -11

T. parvipennis pennata Morse.

Measurements.

	Total length	Pronotum
Female	15-16.8	13.3-14.6
Male	11.5-13	9.8-11.5

The short-winged form is rather more numerous, though neither is very abundant. The species occurs in moist or wet boggy meadows, especially on light soil, and along wet, sandy roadside gutters. Canaan, North Haven, South Kent, Stamford,

Thompson (A. P. M.); Woodbridge, 16 April, Kent, 31 August (W. E. B.); West Haven, 27 June (H. L. V.); New Haven, 26 April, 15, 17 May, Scotland, 25-27 July, Meriden, 29 April (B. H. W.).

TRYXALINÆ.

In the *Tryxalinæ* the vertex of the head is nearly horizontal, the face quite oblique, generally forming an acute angle at the union with the vertex. Lateral foveolæ are usually well developed, though sometimes absent. The eyes are usually longer than that portion of the cheek below their orbits. The antennæ are variable, being acuminate, depressed, or rarely clavate, and situated between or below the middle of the eyes. The pronotum has the front and rear margins of the disk nearly equal in width; all the carinæ are usually distinct, the median carina cut by one sulcus and not raised in the form of a crest. The tegmina and wings are often short and rudimentary, but sometimes fully developed in members of the same species. The inner wing is usually transparent, without bright colors or a black band.

Key to Genera.

1. Antennæ distinctly ensiform (Fig. 13). Face very oblique 2
   Antennæ not ensiform. Face less oblique..... 3
2. Prosternum with obtuse tubercle.....**Pseudopomala** p. 73
   Prosternum without tubercle.....**Tryxalis** p. 72
3. Antennæ linear. Spurs on inner side of posterior tibiæ about equal 4
   Antennæ slightly clavate (Fig. 16). Apical spur on inner side of posterior tibiæ twice as long as the other spur .....**Eritettix** p. 74
4. Foveolæ of the vertex wanting or not visible from above 5
   Foveolæ of the vertex visible from above (Fig. 24).. 9
5. Antennæ short, about equal to head plus pronotum. Tegmina with scapular area not dilated..... 6
   Antennæ long, depressed, from one and one-half (male) to twice (female) as long as head plus pronotum. Scapular area of tegmina dilated (Fig. 23).....
   Chloealtis p. 82

6. Sides of pronotum elongated, the length on dorsal margin greater than the depth (Fig. 18a)..... 7
Sides of pronotum not elongated (Fig. 18b)..... 8
7. Sides of pronotum nearly vertical, flat above, lateral carinæ parallel throughout (Fig. 17a).....
Dichromorpha p. 76
Sides of pronotum convex above, lateral carinæ slightly divergent behind (Fig. 17b).....**Clinocephalus** p. 77
8. Lateral carinæ more or less divergent before and behind (Fig. 20). The middle foveolæ usually present on front edge of vertex (Fig. 21).....**Orphulella** p. 78
9. Tegmina without well developed intercalary vein. Median carinæ of pronotum not high or sharp, and not cut in front of middle by principal sulcus.....
Stenobothrus p. 83
Tegmina with well developed, elevated, intercalary vein. Median carina of pronotum rather high and sharp, cut plainly in front of middle by principal sulcus (Fig. 25) .....**Mecostethus** p. 84

Tryxalis Fabricius.

Head with the vertex horizontal, the front rounded and projecting beyond the eyes to the distance between the eyes. Median carina faint. Lateral foveola absent. Face very oblique. Antennæ flattened at the base, tapering to a point, and about as long as the head plus the pronotum. Pronotum with the disk flat, the median and lateral carinæ distinct and parallel. Median carina cut behind the middle. Lateral lobes of the pronotum parallel and perpendicular, slightly longer than high, the front and hind margins sloping towards each other ventrally. Wing covers usually extending much beyond the end of the abdomen. Hind femora long and slender. Tibiæ with only twelve spines on exterior margin.

T. brevicornis Linnæus. Short-horned Locust. Plate VII, 12.

The females are usually either pale green dotted with brown, or pale brown. The males are much smaller and usually have the dorsal surface, face, fore and middle legs, and face of hind

femora green with the remainder of the body brown. Hind wings transparent with greenish veins.

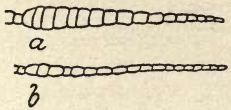


FIG. 13. *a.* Antenna of *Pseudopomala brachyptera.* *b.* Antenna of *Tryxalis brevicornis.*

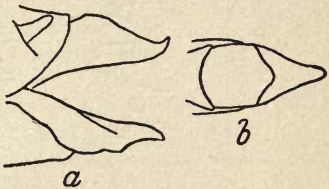


FIG. 14. *Tryxalis brevicornis.* *a.* Lateral view of tip of female abdomen. *b.* Ventral view of tip of male abdomen.

Measurements.

	Length of Body	Antennæ	Tegmina	Hind femora
Female	33	11	30	20
Male	20	10	20	14

We have no record of the capture of this insect in Connecticut. It is a more southern species, but has been taken on Long Island and should be looked for in late summer on the rank weeds and grasses in wet places throughout the southwestern part of the state.

Pseudopomala Morse.

Body long and slender. Head with the vertex horizontal in the female, slightly ascending in the male, and projecting in front of the eyes to a distance equaling its width, and with its anterior margin elongately rounded. The median carina more prominent than in *Tryxalis*. Antennæ ensiform (Fig. 13). Face very oblique, frontal costa prominent, slightly sulcate with the sides nearly parallel. Pronotum about twice as long as broad, the front margin truncate. The disk slightly roof-shaped with lateral carinæ parallel. Prosterum bearing an obtuse tubercle. Tegmina usually abbreviated. Hind femora slender, those of the male with a long, stridulating rasp of fine teeth. Hind tibiæ with 12 to 19 spines on exterior margin. Apical spine absent.

P. brachyptera Scudder. Plate VII, 11.

Light brown with darker brown dots and longitudinal markings. Tips of antennæ, hind tibiæ, and tibial spines more or less

infuscate. Tegmina of male with apical two-thirds nearly transparent, those of the female opaque.

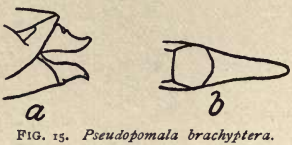


FIG. 15. *Pseudopomala brachyptera.*
a. Lateral view of tip of female abdomen.
b. Ventral view of tip of male abdomen.

Measurements.

	Body	Antennæ	Tegmina	Hind femora
Female	27.5-29.5	8.5-10	7 -12	14 -19
Male	23.5-27	9.5-11.5	9 -12.3	13.5-15.5
Long-winged female			18 -22	
Long-winged male			15.5-17	

This odd-looking insect is sometimes locally common on light waste lands. It is sluggish in its movements and is usually found clinging to the stems of grass, especially the bunch grass, *Andropogon scoparius*. It attempts to escape notice by slipping around to the opposite side of the stem. Canaan, North Haven, Thompson (A. P. M.); Scotland, 25 July-10 August, Plainfield, 14 August (B. H. W.); West Woodstock, September (W.B.).

Eritettix Bruner.

Head with the occiput moderately rounded. The vertex subtriangular, the front rounded. Lateral carinæ usually distinct, sometimes appearing as heavy raised lines. The median carina extends from the pronotum to the front of the vertex. There are also two supplementary carinæ extending from the pronotum to a point opposite the front margin of the eyes where each is sharply bent to meet the lateral carinæ (Fig. 16). Frontal costa gradually divergent, a little constricted about the ocellus and slightly sulcate from the ocellus part way to the vertex. Antennæ somewhat flattened basally and clavate apically. Pronotum with the median and lateral carinæ distinct, cut behind the middle, also a supplementary carina on either side about midway between the median and lateral carinæ. Lateral lobes about as high as long, the front and posterior margins nearly straight, the former rather more oblique. Tegmina and wings usually

well developed. Posterior femora stout, unbanded, and extending to end of abdomen in female, beyond in male.

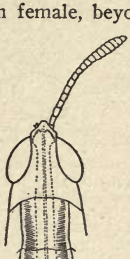


FIG. 16. *Eritettix carinatus.*
Dorsal view of head and pronotum of male.

E. carinatus Scudder.

This is a very pretty species; the two females in our collection are as follows: — General color grayish brown, dorsal field of pronotum with a narrow line of white extending along either side just above the lateral carinæ. Between this line and the supplementary carinæ is a broad band of velvety brownish black which is extended along the top of the head nearly to the vertex, its outer edge narrowed by the upper border of the eye. The central portion of the top of the pronotum between the supplementary carinæ and extending to the front of the vertex is grayish brown. Wing covers not reaching the end of the abdomen; with an indistinct dark median stripe, below which, extending along the basal half of the wing cover, is a greenish white stripe. Hind femora without markings, reaching to the end of the abdomen. The males are darker, with markings less distinct. The wing covers surpass the end of the abdomen by about 3 mm. and the hind femora reach about half-way between the end of the abdomen and the end of the wing covers.

	Measurements.			
	Body	Antennæ	Tegmina	Hind femora
Female	23	5.5	13.5	12
Male	16	5	12.5	10

Scudder gives the Middle States as the locality for this species, and our Connecticut records for this species, published in *Psyche*,*

* *Psyche*. Vol. XI, p. 23, 1904.

were the first ones for New England. It occurs on light dry soil where there is but little vegetation. Two of the specimens captured by the writer were taken in abandoned fields, and the third in a dry pasture. New Haven, 16 June, Mt. Carmel, 31 October, Orange, 2 November (nymphs) (E. J. S. M.); East Haven, 31 May (M. Hebard); Centerville, 25 May to 8 June, Southington, 30 June (B. H. W.).

Dichromorpha Morse.

Vertex much shorter than broad. Lateral carinæ elevated and meeting in front in a blunt point. Median carina and lateral foveolæ absent. Antennæ slightly flattened, about the length of the head plus the pronotum. Dorsal surface of the pronotum flat, with the three carinæ straight and parallel, cut behind the middle by the principal sulcus. Sides of the pronotum perpendicular, longer than deep. Tegmina rarely reaching the end of the abdomen. Hind femora stout, not banded.

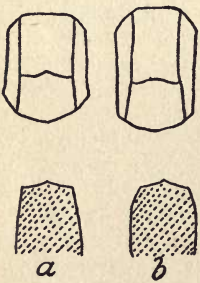


FIG. 17. *a. Dichromorpha viridis.*
b. Clinocephalus elegans.
Disk and cross section of pronotum.

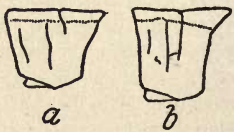


FIG. 18. *a. Dichromorpha viridis.*
b. Orphulella pelidna.
Lateral view of pronotum.

D. viridis Scudder. Short-winged Green Locust. Plate VIII, 1.

This species is dimorphic as regards form and color. The male is nearly always green above and dull brown below. Rarely males occur which are brown above. The females are either bright green or dull brown. Tegmina ovate lanceolate, about one-half the length of the abdomen in the female, three-fourths in the male. Hind femora reaching the end of the abdomen in

the female and extending beyond about one-fourth their length in the male.

Occasionally in the female the tegmina reach the end of the abdomen. This form has been named *punctulata,* and may be either green or brown, the former color predominating. *Punctulata* males are very rare. The collection contains two males with the tegmina longer than any that the writer has seen recorded.

	Measurements.			
	Body	Antennæ	Tegmina	Hind femora
Female	23-27	7 -8	8-10	14 -15
Male	15-16	6.5-8.5	6- 9	9.5-10.5
Long-winged form				
Female			19	
Male			14	

A common species. Delights in moist places where the grass is luxuriant and green throughout the season. Taken in various parts of the state from 17 July until 23 October.

Clinocephalus Morse.

Vertex shorter than broad, lateral carinæ elevated and meeting in front in a blunt point. Median carina and lateral foveolæ not present. Antennæ slender, longer than the head plus the pronotum (male), or as long as the head plus the prozona (female). Pronotum with the disk nearly flat, the three carinæ well developed, the lateral carinæ parallel on the prozona, slightly divergent on the metazona, cut behind the middle by the principal sulcus. Sides of the pronotum longer than deep, perpendicular below, convex on the upper third. Tegmina nearly or quite reaching the tip of the abdomen. Hind femora slender, not banded.

"This genus occupies an intermediate place between *Dichromorpha* and *Orphulella,* and is closely related to the former, from which it differs especially in having the sides of the pronotum convex below the lateral carinæ, which, in addition, are slightly divergent on the metazona."

C. elegans Morse. Fig. 17.

The general color varies from light olivaceous green to dark greenish brown. A dark brown or blackish stripe reaching from

the posterior border of the eye along the upper part of the lateral lobes of the pronotum and sometimes to the humeral field of the tegmina; sometimes this band is faint. The female may be taken for that of *Stenobothrus curtipennis* but is readily distinguished by the absence of foveolæ and the more elongated pronotum with the less divergent lateral carinæ.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	20.5-23	5	12	12.3
Male	17	7.5-8	10.5	10

This species has not been taken in Connecticut, but occurs in New Jersey, and should be looked for in the southern part of the state.

Orphulella Giglio-Tos.

Vertex nearly horizontal, not extending beyond the eyes for a distance greater than its width. Median carina, if present, very faint. Lateral foveolæ small and not visible from above. Pronotum with the median carina sharp, cut either at or behind the middle. The lateral carinæ divergent before and behind the middle. Lateral lobes of pronotum as broad as long; front border moderately oblique; hind border less oblique and slightly sinuate. Tegmina and wings well developed. The tegmina narrow, little shorter than the abdomen in some species and considerably longer in others. Hind femora of medium size, often banded.

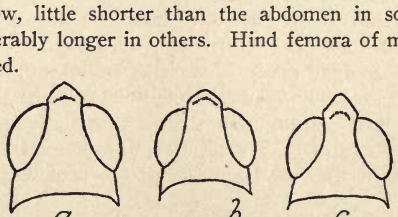


FIG. 19. *a. Orphulella pelidna. b. Orphulella speciosa. c. Orphulella olivacea.* Dorsal view of head of male.

FIG. 20. *a. Orphulella pelidna. b. Orphulella speciosa. c. Orphulella olivacea.* Disk of pronotum, female.

Three species are found in Connecticut. These are difficult to determine, as individuals of the same species vary greatly in color, markings, and even structure.

Key to Species.

Vertex of head about right-angled or a little acute in the male, slightly narrowed between the eyes. The central depression back one-fourth to one-third the width of the vertex. Lateral carinæ of pronotum strongly incurved and the distance between them at hind margin much greater than at front margin. Median carina cut at middle. Tegmina usually surpassing hind femora (Figs. 19a and 20a).....**pelidna**

Vertex of head blunt, rounded, obtuse in the female, right-angled in the male, scarcely narrowed between the eyes. The central depression close to apex. Lateral carinæ of pronotum little incurved, the distance between them but little greater at hind margin than at the front. Median carina cut back of the middle. Tegmina about reaching end of hind femora, often shorter, rarely surpassing it (Figs. 19b and 20b) .....**speciosa**

Vertex of head acute, the sides often incurved in the males, distinctly narrowed between the eyes. Central depression back from the apex about one-half the width of the vertex. Lateral carinæ of pronotum little incurved, the distance between them much greater at hind margin than at the front. Median carina cut back of the middle. Tegmina usually extending beyond the hind femora (Figs. 19c and 20c)....**olivacea**

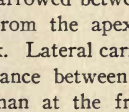


FIG. 21. *Orphulella pelidna*, female. Lateral view of head.

O. pelidna Burmeister. Figs. 19a and 20a.

Head with the vertex raised above the disk. Median carina absent. Foveolæ distinct, narrowly triangular. Frontal costa

rounded at the union with the vertex. The hind femora of the female usually slightly exceeding the end of the abdomen, those of the male extending about 2 mm. beyond. The tegmina always reach to the end of the hind femora, and usually pass it from 1.5 to 3 mm. in the female and from 1 to 4.5 mm. in the male. Tegmina with a median band of square black spots, and with the sides nearly parallel. Color is variable, brownish specimens being most common. The top of the head and pronotum and the median and dorsal portion of tegmina may be brown, rose-red, or green. Bright green males are rather rare. The top of the head and pronotum often have a pair of velvety, brownish-black stripes, with the carinæ whitish. There is usually a dark band from the rear of the eyes along the top border of the lobes of the pronotum, and a blackish triangular patch on either side of the disk of the metazona next to the lateral carinæ. Specimens thus marked appear at a glance as belonging to a species entirely different from the individuals with a solid color on the upper surface.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	16.5-23.5	5.5-7	13.5-20	10.5-12.5
Male	14.5-15.5	4.7-6.5	12.5-16.5	8.5- 9.8

This species occurs from the middle of July until about the middle of September, and Morse states that it is found on the drier portions of the land adjoining the salt marshes, on the more densely grassed portions of ground just inshore of the sandy beaches, and on loamy or sandy soil further inland. Some of the inland records are as follows: — Montville, Thompson (A. P. M.); Scotland, 27 July to 10 August, Canterbury, 14 August (B. H. W.).

O. speciosa Scudder. Plate VIII, 2. Figs 19b and 20b. Head with the vertex more blunt than in *pelidna*. Margins of vertex less raised. Foveolæ less distinct. The disk of the pronotum more nearly equal in width at the anterior and posterior margins and the sides less constricted at the middle than in the two other species. The principal sulcus cuts the disk somewhat behind the middle. The tegmina usually reach about to the end of the hind femora, though they vary from 1.5 mm. short

of the end of the femora to 2 mm. beyond in the female, and in the male from 3 mm. short of the end to 3 mm. beyond. The tegmina taper slightly towards the apex. The color of this species is even more variable than in *pelidna,* having not only the same color forms as the latter, but many intermediate shades. Morse gives the more striking variations as follows:

	Head	Pronotum	Tegmina
1	Green	Green	Green
2	Green	Green	Rose-red
3	Brown	Brown	Rose-red
4	Brown	Brown	Brown.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	16-21.5	5 -6.5	9-16	9.5-12
Male	13-14	4.5-6.5	10-13.3	8.5-10

This species, which is one of the most abundant species of *Tryxalinæ,* is found throughout New England, while the other two species occur principally in the southern part. *Speciosa* is found on rather light soil of pastures and cultivated fields. We have taken specimens in various parts of the state from 19 July to 3 October.

O. olivacea Morse. Figs. 19c and 20c.

Allied to *pelidna.* Aside from the differences in the key the vertex is more nearly horizontal and meets the front at a sharper angle. The face is more oblique and the antennæ shorter. The pronotum is longer and the prozona wider, with the lateral carinæ less incurved and forming straight lines rather than curves. It differs from *speciosa* in having the lateral carinæ strongly divergent on the metazona, making the disk much wider at the posterior margin than the anterior. The tegmina surpass the hind femora by at least 2 mm., tapering somewhat towards the apex. The color is more uniform than in the other two species, being in general pale brown to dark olive brown, or light green above and pale brown below. Darker markings more or less similar to those of other species. The colors have a peculiar olivaceous tinge which corresponds to the tints of the vegetation where it is found. *Olivacea* is somewhat the largest of the three species.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	21-25	6	17-21	12.5-14
Male	16.5-18.7	6-7	14-17	10 -10.5

This species was described by Prof. Morse from specimens which he took at Greenwich and Stamford, August 11th to 28th. It has also been taken at New Haven (B. H. W.). In regard to its occurrence Morse says, "This species, though not widely spread, was locally very plenty in the salt marshes, its green and olivaceous tints closely matching in color the marsh grasses in which it made its home. The ground beneath was often overflowed at high tide and offered a retreat to myriads of fiddler crabs, being much wetter and of a wholly different character from the situations frequented by *pelidna* and *speciosa*."

Chloealtis Harris.

Head with the vertex triangular, the margins but little raised. Median carina faint, but present. Foveolæ absent. Antennæ flattened at base, nearly one and one-half times (females) or twice (males) the length of head and pronotum. Pronotum with the three carinæ present and cut much behind the middle by the principal sulcus. Lateral carinæ but little incurved in the male, slightly more so in the female. Lateral lobes of the pronotum a little longer than deep, the front and hind margins straight, both strongly and equally oblique. The lower margins with the back portion nearly horizontal and the front portion ascending. Tegmina of female usually abbreviated and wings abortive, while those of the male are well developed, with the scapular area well developed and with many cross veins. Hind femora of medium size and banded on the upper face. Ovipositor short, the upper valves enlarged and strongly toothed at base (Fig. 22).

FIG. 22. *Chloealtis conspersa*, female. Tip of abdomen, from side.

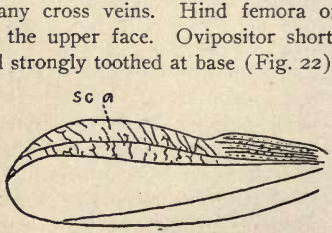


FIG. 23. *Chloealtis conspersa*, male. Tegmen.

C. conspersa Harris. Plate VIII, 3.

Females dull yellow to dark brown. Pronotum with a more or less distinct blackish band along the upper margin. The first two or three abdominal segments with more or less black. Tegmina usually more or less sprinkled with dark dots. The males usually light brown above, with the lateral lobes of the pronotum always shiny black and the first abdominal segments with the sides black. The tegmina of females about one-half the length of the abdomen, while those of the male reach nearly to the tip. The inner wings much shorter. The hind femora of both sexes with two light spots on the outer face.

	Measurements.			
	Body	Antennæ	Tegmina	Hind Femora
Female	20-28	10-12	7 -10	11.5-16
Male	15-18	10-11	7.7-12	10.7-13

Occurs along the edges of dry, open woods, and in neglected fence corners. Eggs are deposited in fence rails or dry sticks and logs.

Stenobothrus Fischer.

Vertex obtusely triangular in female, acute in male. Foveolæ plainly seen from above as linear depressions. Median carina absent. Antennæ longer than head plus pronotum, nearly twice as long in the male. Median carina of pronotum cut somewhat behind the middle, the lateral carinæ incurved. Lateral lobes of the pronotum about as long as deep, nearly straight on front margin, sinuate on the back and lower margins. Tegmina variable, usually short in female and well developed in male. Wings slightly shorter than the tegmina. Hind femora rather slender, without cross-bars.

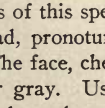


FIG. 24. *Stenobothrus curtipennis*, female. Head, from above.

S. curtipennis Harris. Short-winged Brown Locust. Plate VIII, 4.

The color and markings of this species are extremely variable. The dorsal surface of head, pronotum, and tegmina vary from light brown to fuscous. The face, cheeks, and sides of pronotum may be fuscous, green, or gray. Usually a dark fuscous band from the back of the eye along the upper border of the sides of

the pronotum. The antennæ yellowish brown at base, dark brown or black towards the tips. The sides of the abdomen marked with black and the knees of the hind legs also black. The tegmina are extremely variable, and, while most of the individuals belong either to the short-winged or to the long-winged forms, no line can be drawn between them, as many examples are found varying from one form to the other. In the short-winged specimens the tegmina usually lack 3-5 mm. (females) or 2-3 mm. (males) of reaching the end of the hind femora. In the long-winged form they reach the end of the hind femora or pass it by 1-2 mm. The hind wings are always present, somewhat shorter than the tegmina, their usefulness depending upon their size. The males resemble those of *Chloealtis conspersa,* but are readily distinguished by the presence of the foveolæ (Fig. 24).

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	15 -24.5	6.5- 8	7 -16.5	11.5-14
Male	13.5-15.5	8.5-10.5	8.5-15	10.5-11.8

This species is often abundant in the tall grass of moist meadows, along ditches, or wherever the vegetation is thick and succulent. Morse states, "The season during which it may be procured in the adult state is the longest of all our locusts. I have captured specimens from June 24th to November 17th." We have taken it in various parts of the state from 11 July to 4 October.

Mecostethus Fieber.

Head with the vertex horizontal, the median and lateral carinæ distinct, the latter straight. Apex truncate or broadly rounded. Lateral foveolæ small, triangular. Antennæ of male slightly exceeding the head plus the pronotum. Pronotum with the three carinæ distinct, the median carina prominent, cut somewhat in front of the middle. The disk rugose, with the posterior margin obtuse or rounded. The lateral lobes about as deep as long. Tegmina and wings well developed, usually surpassing the tip of the abdomen in both sexes. The intercalary vein elevated, and in the male furnished with a stridulating rasp. Hind femora rather slender, exceeding the tip of the abdomen in the male. Sub-anal plate of the male long, at least twice the

length of its greatest depth. Valves of the ovipositor strongly protruding.

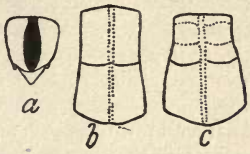


FIG. 25. *a. Mecostethus platypterus*, male. Ventral view of tip of abdomen.
b. M. platypterus, female. Disk of pronotum.
c. M. lineatus, female. Disk of pronotum.

Key to Species.

Lateral carinæ of pronotum distinctly divergent behind. Prozona shorter than the metazona. Scapular area of tegmina with a pale basal streak.....**lineatus**

Lateral carinæ of the pronotum nearly parallel. Prozona and metazona of about equal length. Scapular area of tegmina without a pale basal streak.....**platypterus**

M. lineatus Scudder.

General color yellowish to dark brown, the males usually the lighter. A narrow yellow line (more or less obscure in the female) extending from the upper border of the eye to the pronotum; below this is an indistinct dark band extending across the upper part of the lateral lobes of pronotum. The tegmina with a distinct yellow streak along the base of the discoidal area, extending from one-half to two-thirds their length. Hind femora with the outer face yellowish or reddish brown, darker below, with the lower face usually bright red, the apex black. Hind tibiæ yellowish with a pale ring towards the base; spines black. The tegmina of this species are narrower and of a more uniform color than in *platypterus*. The teeth of the rasp are low and dull. The under side of the ninth abdominal segment of the male has no mid-stripe of black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	34-38	10-11.5	26-31.5	18-21
Male	23-27	11-12	21-26.5	14.5-18

Morse states, "Though somewhat local, this species is rather common in southern New England in wet, sedgy meadows along

rivers and brooks and in swampy tracts where water often stands on the ground for days at a time — may be looked for from the middle of July till the end of the season." North Haven, Thompson (A. P. M.); West Woodstock (W. B.); New Haven, 20 July (B. H. W.).

M. platypterus.

General color a darker brown than in *lineatus*. The dorsal margin of tegmina a grayish brown, with no yellow stripe along the scapular area. The ninth abdominal segment of the male has on the under (ventral) side a mid-stripe of black (Fig. 25a), which is not present in *lineatus*.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	35-40	10-11	24-25	17.6-20.6
Male	23-26	11-12.5	19-21	15 -16.5

This species has been taken by Professor Morse at Thompson in company with *lineatus*, but is much less common, the female hard to flush and consequently difficult to secure.

ŒDIPODINÆ.

Head with the vertex sloping downward, the face nearly vertical, rounded where joined to the vertex. Eyes rather small, shorter than the portion of the cheek below their orbits. Antennæ linear or sub-linear, situated above the middle of the eyes, sometimes almost above the eyes themselves. Disk of the pronotum with the rear margin much wider than the anterior margin. The lateral carinæ usually not distinct, the median carina wholly or at least partly crested, and cut by one or two sulci (except in *Arphia*, in which the median carina is entire). The tegmina and wings fully developed, usually bright-colored, and with a dark median band.

Key to Genera.

1. Median carina of pronotum in female always cut by one or more sulci. Tegmina with apical half membranous and regularly reticulate 2

   Median carina of pronotum not cut by principal sulcus (Fig. 26). Tegmina with apical half leathery and irregularly reticulate .....**Arphia** p. 88

2. Median carina cut by only one sulcus..... 3
Median carina cut by two sulci, the front notch often less distinct than the posterior..... 9
3. Disk of inner wing nearly transparent, not distinctly bounded by black border..... 4
Disk of inner wing opaque, colored (red, orange, yellow, or black), bounded by black border except when disk is black 6
4. Pronotum with the disk flat, the dorsal front margin truncate. Hind femora with dusky cross-bars on outer face 5
Pronotum with the disk roof-shaped, sides sloping downward, dorsal front margin angulate. Hind femora without dusky cross-bars on outer face.....
Chortophaga p. 90
5. Frontal costa of male strongly sulcate the entire length. Median carina of pronotum prominent, higher on prozona than on metazona, distinctly cut by the principal sulcus .....**Encoptolophus** p. 91
Frontal costa of male sulcate only just below the ocellus. Median carina of pronotum low, of equal height throughout, faintly cut by principal sulcus.....
Camnula p. 92
6. Body slender, often compressed. Pronotum with the lateral carinæ extending only to the principal sulcus and cut by it..... 7
Body, especially of female, robust. Pronotum with the lateral carinæ extending in front of the principal sulcus and not cut by it (Fig. 28). Disk of pronotum often with numerous tubercles.....**Hippiscus** p. 93
7. Disk of wing yellow with dark median band..... 8
Disk of wing black with pale border (Plate IX, 1)....
Dissosteira p. 96
8. Size medium; female usually over 30 mm., male over 26 mm. in length .....**Spharagemon** p. 97
Size smaller, female usually less than 30 mm., male less than 25 mm. in length .....**Scirtetica** p. 101
9. Antennæ of male shorter than the hind femora, basal joints not strongly flattened. Frontal costa above the ocellus wider than the basal joints of antennæ.. 10

Antennæ of male longer than hind femora, the basal joints strongly flattened. Frontal costa narrowed towards apex, but at the widest point above the ocellus narrower than the basal joints of antennæ.....
Psinidia p. 102

10. Hind tibiæ entirely pale. General color light brown or buff and white. Radial veins of wings not enlarged
Trimerotropis p. 103

Hind tibiæ dusky towards base and at tip. General color dark gray or black. Wings with two or three radial veins distinctly enlarged (Fig. 34) .....
Circotettix p. 104

Arphia Stål.

Vertex of the head triangular with the apex blunt or truncate, the disk with a distinct, usually deep, transverse curved depression back of the middle. Lateral carinæ distinct, the median carina broken by the depression. Foveolæ rather large but shallow. Frontal costa rather broad and sulcate around and below the ocellus. Pronotum with the medium carina compressed, high, and not notched by the principal sulcus. The front margin obtusely angulate and extended upon the posterior third of the occiput. Lateral edges of the disk rounded, lateral carinæ distinct only on the metazona. Sides of the pronotum not as long as deep. Tegmina leathery in texture, densely and irregularly reticulate. Inner wings (of our species) yellow at base. Hind femora stout, the basal half broadly flattened.

FIG. 26. *a. Arphia sulphurea*, male.
b. Arphia xanthoptera, male.
Lateral view of pronotum.

Key to Species.

Frontal costa with the upper third narrowed, the sides approaching each other and meeting at connection with the vertex. Median carina of pronotum moderately

elevated, but little arched. Hind margin of pronotum right-angled in male, slightly obtuse in female **sulphurea**

Frontal costa with the sides scarcely approaching each other, not meeting at the union with the vertex. Median carina high and arched. Hind margin of the pronotum acute-angled ..... **xanthoptera**

A. sulphurea Fabricius. Sulphur-winged Locust.

General color yellowish brown to blackish brown in the males. Females usually somewhat lighter than the males. The tegmina in both more or less sprinkled with darker brown dots. The inner wings with the basal two-thirds a bright sulphur yellow; the outer third with a curved dusky band. Just back from the front margin of the wing and extending from the dusky band, is a streak of the same color, reaching nearly to the base of the

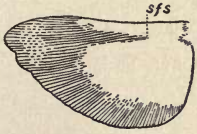


FIG. 27. *Arphia sulphurea*, male.
Wing. *sfs*, sub-frontal shoot.

wing, Fig. 27.* Hind femora with a pale ring near the apex, the inner surface with alternate bands of black and white, which are often faintly extended to the outer surface. Hind tibiæ nearly black or bluish black with a pale ring near the base.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Females	26-28	6-7.5	20.5-23	13.5-15.2
Males	17-19	6-7.5	17.5-20	11 -12.5

A very common species found in dry pastures. It commences to appear in early May and is most abundant through June and early July, though scattering specimens are found much later. The males, when disturbed, fly in short, zigzag flights, making a crackling noise.

* This is sometimes called the sub-frontal shoot, and this term will be used when this character is referred to in following species.

A. xanthoptera Germar. Plate VIII, 5.

This species is somewhat larger than *sulphurea* and will be readily recognized by the characters given in the key. The front of the vertex is truncate; its lateral carinæ do not meet but are continuous with the sides of the frontal costa, which scarcely approach each other, and do not meet at the apex. The color varies from yellowish brown or bright reddish brown to nearly black. The tegmina, especially of the female, are sprinkled with dark. The disks of the wings are of a deeper yellow than in *sulphurea*. The sub-frontal shoot is about as long as the width of the band, and reaches less than half-way to the base of the wing.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	28-32	9-11.5	26.5-30	17 -18.5
Male	21-25	10-11	22.5-27	14.6-17.3

This species occurs in similar locations to, and with *sulphurea*, replacing it during the latter part of the season.

Chortophaga Saussure.

Body rather slender, compressed, and punctate or finely wrinkled. Vertex triangular, the apex truncate. Median carina absent. Lateral carinæ rather faint. Lateral foveolæ triangular and very shallow. Frontal costa rather narrow, the lower part sulcate, the sides approaching each other slightly on the upper part and meeting those of the vertex. Antennæ rather short and flattened. Disk of pronotum roof-shaped, the front obtusely angled and produced forward slightly upon the occiput, the posterior margin acute-angled. Median carina prominent, slightly curved in profile, faintly cut a little before the middle. Lateral lobes of the pronotum deeper than long. Tegmina narrow, extending beyond the abdomen. Inner wings with the apical half somewhat smoky. Hind femora of medium size, surpassing the abdomen in male, usually slightly shorter than the abdomen in female.

C. viridifasciata DeGeer. Green-striped Locust. Plate VIII, 6.

This is the only species of our *Œdipodinæ* that is dimorphic in regard to color. Several forms have been described; but,

as they grade into each other, only two forms are usually recognized, the green form, *virginiana,* and the brown form, *infuscata.* Many of the females can be referred to the green form while the majority of the males are brown. *Virginiana* usually has the head, pronotum, and outer face of hind femora bright green with a broad stripe of the same color along the basal two-thirds of the outer edge of the tegmina. The remainder of tegmina is light brown, and the abdomen reddish brown. In the brown form the tegmina are more or less mottled with light and dark brown. The inner wings of both forms are transparent, yellowish at the base, with the apical two-thirds smoky, becoming paler at apex; along the middle of the front margin is a dark bar. Hind tibiæ pale to dark brown, often with a pink, purple, or bluish cast, and with more or less distinct black bars on inner face which often show on the upper outer groove.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	22-32	6-8	18.6-25	13 -15.5
Male	17-20	6-8	16.8-20	10.5-12.5

This species passes the winter in the nymph stage and the adults appear during the last of April, being the earliest as well as one of the most common of our springtime locusts. It is scarce during August, but is found from September until frost. It occurs throughout the state.

Encoptolophus Scudder.

Head somewhat swollen. Body a little shorter and stouter than in *Chortophaga.* Vertex broad, triangular, with the disk lower than the occiput. Median carina present but reaching only to the middle of the disk. Foveolæ long, triangular. Frontal costa narrow, deeply sulcate its entire length in the male, sulcate only above the ocellus in the female. Antennæ about as long as the head plus the pronotum in the female, somewhat longer in the male, moderately flattened apically. Pronotum with the disk flat, the front margin nearly truncate, the posterior margin right-angled. The median carina cut at the middle, the front half slightly higher. The sides deeper than long, compressed, and much wrinkled. Tegmina rather broad, equaling or slightly surpassing the abdomen in the female, always surpassing it in the

male. The intercalary vein much nearer the ulnar vein than the median, and the discoidal area as wide as the widest part of ulnar area.

E. sordidus Burmeister. Clouded Locust.

Color rusty yellow or dark brown, mottled with darker or lighter shades of brown. In living specimens the disk of the pronotum often with a pinkish buff, X-shaped mark. Hind margin of pronotum often marked with dark velvety brown. Tegmina with two rather irregular, distinct pale bands. Inner wings transparent yellowish at base, the outer half smoky and becoming darker at apex. Hind femora with faint bands of pale and dark brown. Hind tibiæ with pale ring near the base.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	24-35	8-9	20.5-24	14-15.5
Male	19-21.5	8-9	16-19.5	11-12

This species appears about the first of August, and is very common in old pastures and fields throughout the state during the remainder of the season.

Camnula Stål.

Size rather smaller than the average of the *Œdipodinæ*. Head compressed, vertex ovate in male, broader in female, with the front sloping downward. Median carina very faint, hardly showing in male. Foveolæ indistinct. Frontal costa not prominent, nearly flat, sulcate around the ocellus. Antennæ short and slender. Pronotum with the disk flat and smooth, truncate in front, obtusely angled behind. Median carina low, of equal height throughout, faintly cut in front of the middle. Sides of pronotum deeper than long. Tegmina narrow, reaching beyond the abdomen. Inner wings pellucid.

C. pellucida Scudder. Clear-winged Locust. Plate VIII, 7.

Light yellowish brown to fuscous. Antennæ pale at base, darker towards apex. A dark, somewhat triangular spot behind the eye, and a vertical elongated mark on and often nearly covering the front half of the lateral lobes of pronotum. Tegmina dark brown towards base, smoky towards apex, irregularly

marked with patches of light and dark. The dorsal surface dark brown with a yellow stripe along each humeral angle. Inner wings transparent with the nervules dark. Hind femora yellowish with the apex fuscous and faintly marked with dark bars. Hind tibiæ yellowish brown, paler towards base.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	21-28	6-8.5	19 -23.5	11 -14.7
Male	17-21	7-9	15.5-18.5	9.5-12.3

Morse states: "In the markings of the tegmina, form, and color, *pellucida* looks like a diminutive *Hippiscus*, to which genus *Camnula* is not distantly related. It varies much in size and tegminal markings, but is not likely to be confused with any other species found here. It is extremely common, even abundant locally, throughout the northern part of New England, being probably the most numerous in point of individuals of any of our *Œdipodinæ*. It is found in dry grassy pastures and over other untilled lands, preferably on high ground. . . . It begins to appear in the winged state about July 1st and may be found during the rest of the season."

In Connecticut it occurs locally in the higher portions throughout the northern part. Thompson ("Not uncommon in a locality on north side of a high drumlin a mile east of village"), South Kent (A. P. M.); Colebrook, 21 July (H. L. V.).

Hippiscus Saussure.

Our species of this genus rather large and robust. Head large with swollen cheeks. Disk of vertex sloping downward, broad, triangular, with apex obtusely rounded. Lateral carinæ not sharp. Median carina distinct at least on posterior half and extending back on the occiput. Foveolæ inconspicuous, usually triangular. Antennæ about the length of head. Pronotum slightly flattened apically; the disk flat, more or less roughened and with numerous blunt tubercles, truncate and somewhat constricted in front, usually right-angled or obtuse at posterior margin. Median carina distinct and cut by the principal sulcus. The lateral carinæ extending somewhat beyond the principal sulcus and not cut by it. Lateral lobes of pronotum

constricted a little in front of the middle, about as long as deep. Tegmina extending considerably beyond the abdomen, especially in the male. Hind femora broad, flattened.

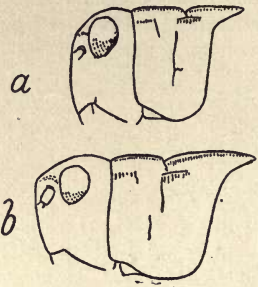


FIG. 28. *a. Hippiscus rugosus*, female.
b. Hippiscus tuberculatus, female.
Lateral view of head and pronotum.

Key to species.

Vertex much produced in front of eyes. Pronotum with the hind margin of vertex acutely angled. The prozona much shorter than the metazona.....**tuberculatus**

Vertex less produced in front of eyes. Pronotum with the hind margin of vertex obtuse (female) or right-angled (male). The prozona and metazona about equal in length **rugosus**

H. tuberculatus Palisot de Beauvois. Coral-winged Locust. Plate VIII, 8, 9.

Vertex considerably produced, sloping downward, and meeting the front at an angle (Fig. 28b). The lateral carinæ are distinct and are continuous with those of the frontal costa. Median carina distinct on occiput and extending to center of disk. Foveolæ very small, triangular. Pronotum with the disk granulated with small roundish tubercles. Hind femora very broad and flattened. General color ash-brown, darker above. Antennæ yellowish at base, darker towards the apex. Pronotum with a short longitudinal bar on the middle of the lateral lobes. Tegmina with fuscous and black patches. Humeral angle usually

light brown. Wings generally bright coral red, rarely yellow, at base, bordered by a curved fuscous band with a sub-frontal shoot extending nearly to the base. The outer face of hind femora with faint blackish bars; the inner face black at base, with the apical half yellow and crossed by a narrow black band. Hind tibiæ yellowish to bright brown.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	36-44	11.5-13.5	30-32	18.5-20.5
Male	25-28	10.5-12	24-30	14 -16

This is our largest locust belonging to the *Œdipodinæ*. The males are ready fliers, taking to wing upon being approached. The female seldom flies up more than once and often escapes notice by remaining quiet. The species is found in dry, bushy pastures, on hillsides, or on light, uncultivated soils. The young appear about the first of September, and are "curious little depressed toadlike objects usually purplish leaden in color." This species reaches the adult stage the last of April or the first of May and is found until the latter part of July. Our earliest record is April 28. Thompson, South Kent (A. P. M.); New Haven, 4 May, 12 May, Oxford, 21 May, Rainbow, 24 May (W. E. B.); New Haven, 17 June (E. J. S. M.); Hamden 28 April, New Haven, 4 May, 14 June, Milldale, 21 May (B. H. W.).

H. rugosus Scudder.

This species is similar in size to *tuberculatus*. The vertex does not extend so far in front of the eyes and is more rounded at the connection with the face (Fig. 28a). The median carina extends to the front and a cross carina divides the disk into four nearly equal parts. Pronotum with the surface of the disk with numerous oblong or elongated tubercles, the hind margin obtusely angled. The disk of the hind wings usually pale yellow but varying to orange.

H. rugosus is very rare in New England and has not been recorded from Connecticut. It has been taken in Norway, Maine, and in Eastern Massachusetts. Scudder gives the distribution as "U. S. east of the Rocky Mountains." It should be looked for in localities similar to those inhabited by *tuberculatus*.

Dissosteira Scudder.

Body slender, compressed, with the head rather prominent. Disk of vertex somewhat ovate, the front truncate. Lateral carinæ low; the median carina faint. Foveolæ small, triangular. Frontal costa sulcate, a little narrowed above and below the ocellus. Disk of pronotum with the front margin nearly truncate, the posterior angle obtuse. Median carina high, cut in front of the middle by a deep narrow notch, the posterior portion strongly arched. Lateral carinæ rounded, extending only to the principal sulcus. Lateral lobes of pronotum deeper than long. Tegmina broad, extending about a third of their length beyond the end of the abdomen. The intercalary vein prominent and about midway between the median and ulnar veins. Inner wings large, black, with a narrow yellowish border along the outer edge as far as the apex, which is fuscous. Hind femora rather stout, but small for the size of the species, shorter than the abdomen in both sexes.

D. carolina Linnæus. Carolina Locust. Plate IX, 1.

Color varying from light grayish yellow to dark fuscous. The tegmina usually thickly sprinkled with small dark dots, though specimens occur with the tegmina almost unspotted. Inner wings nearly black with the outer border pale greenish yellow, the apex smoky with several darker spots. Hind femora with the inner face whitish and crossed with three blackish bands, the first nearly covering the basal half. Hind tibiæ dirty yellow, usually with a whitish annulus near the base.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	33-42	11.5-13	36-43	15.5-20.5
Male	24-28	9.5-11	28-33.5	12.6-14.7

The Carolina locust is familiar to every one. It occurs along the roadside, in cultivated fields, and especially in places where there is more or less bare earth. It is a strong flier, and when alighting generally chooses a bare spot of ground with which the colors often harmonize so that it is very hard to detect. This locust is found throughout Connecticut; in fact, it is distributed all

over the United States and Canada, except on the highest elevations. The adults appear about the first of July and are found until frost.

Spharagemon Scudder.

Body slender, somewhat compressed. Head somewhat swollen dorsally. Vertex with the lateral carinæ converging more rapidly than in *Dissosteira*. Median carina faint or wanting. Lateral foveolæ more distinct than in *Dissosteira*. Frontal costa narrow, sulcate around and below the ocellus. Antennæ about as long as hind femora, slightly flattened towards the base. Pronotum with the disk much as in *Dissosteira*. The median carina prominent, usually high and deeply cut in front of the middle by a narrow notch. Tegmina considerably surpassing the abdomen in both sexes, the intercalary vein less prominent than in the previous genus and nearer the median than the ulnar vein. Inner wings with the base yellow, bordered by a dark median band. Hind femora rather stout, nearly reaching (female) or surpassing (male) the end of the abdomen. Hind tibiæ in our species with considerable red.

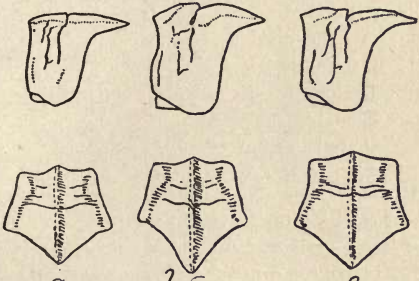


FIG. 29. *a. Spharagemon bolli*, female. *b. Spharagemon collare scudderi*, female. *c. Spharagemon saxatile*, female. Lateral view, and disk, of pronotum.

Key to Species.

1. Pronotum with the hind margin about right-angled. Notch in median carina vertical 2
   Pronotum with the hind margin acute-angled. Notch of median carina oblique, the sides often overlapping (Fig. 29b) .....**collare** var.

2. Median carina rather high, the notch narrow, disk of prozona not elevated (Fig. 29a). Hind tibiæ with a pale ring followed by an equally wide dusky band **bolli**

Median carina lower, the notch deeper and more open, disk of prozona somewhat elevated (Fig. 29c). Hind tibiæ very rarely with a distinct dark band following the light basal ring..... **saxatile**

S. collare Scudder, vars. **scudderi** Morse, and **wyomingianum** Thomas.

These two forms of *collare* are readily distinguished from *bolli* and *saxatile* by the characters given in the key. The general color is pale yellow to pinkish brown in *wyomingianum,* often more rusty in *scudderi* and thickly sprinkled with dark brown or fuscous. The face is often ash-gray, the disk of the pronotum usually with an indistinct, pale, X-shaped mark. Tegmina with the dark markings arranged in more or less distinct bars. Hind femora grayish brown with traces of four dark bars on the outer face. Hind wings pale yellow with the median band nearly or quite reaching the anal angle. Sub-frontal shoot reaching one-third to one-half the distance to the base of the wing. Hind tibiæ coral-red, more or less sprinkled with dusky spots at base.

The typical *collare* is distributed throughout the central states but does not occur in Connecticut.

Morse points out the difference between *scudderi* and *wyomingianum* as follows: — "*Wyomingianum* may be readily distinguished from *scudderi* by its inferior size, the female of the former about equaling the male of the latter. In *wyomingianum* the head is less compressed, especially above; the eyes are much larger proportionally and are more prominent; and the antennæ are longer in proportion. The facial costa is rather more sulcate, especially in the male. The pronotum presents no distinctive characters, though in *wyomingianum* it is rather less compressed, and the posterior process rather more acute than in *scudderi.* In *wyomingianum* the hind femora are less distinctly fasciate externally, and internally show a decided difference; in *wyomingianum* the proximal fuscous band is obsolete ventrally, and the proximal two are not connected; while in *scudderi* the proximal band is complete, and the proximal two are broadly con-

nected in tibial groove and on inner side, giving the appearance from below of a single, very broad fascia. In *wyomingianum* the hind tibiæ seem to be more often annulate with pale basally, and are less vivid in color. In *wyomingianum* the pubescence of the hind femora seems to be more highly developed than in *scudderi,* but individuals vary much. The color of the body as a whole is very similar, but *wyomingianum* has more of a yellowish cast, while in *scudderi* reddish or rusty predominates. This difference, however, is doubtless due merely to the character of its haunts."

wyomingianum Thomas.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	24-29	10 -13	23 -25.5	12.5-15
Male	18-20	9.5-12	18.5-20.5	11 -12

Occurs in dry, open, upland fields. Niantic, Thompson, North Windham, North Haven (A. P. M.); Scotland, 11 August (B. H. W.).

scudderi Morse.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	27-29	11 -11.5	25.5-28.5	14-16.5
Male	21-23	11.5-12.5	23 -24.5	13-14

This is a rather more southern form, and is often found locally common on light sandy soils and around sandy areas. Plainfield, 14 August, Scotland, 10 August (B. H. W.).

S. bolli Scudder. Boll's Locust. Plate IX, 2.

General color, yellowish to rusty brown in the female, the males being slightly darker, usually grayish to fuscous. Tegmina sprinkled with dark spots, which are grouped into three more or less distinct cross-bars, much more prominent in the males. Inner wings pale greenish at base, the median band broad, not reaching the anal angle of the wing. Sub-frontal shoot reaching about one-third the distance to the base. Apical portion of the wing transparent with the tip in the male often dark like the median band. The inner face of the hind femora yellow with three black bands; the outer face yellow, grayish, or rusty red with

traces of the dark bands. Hind tibiæ dark at the base, the dark area bounded distally by a whitish ring, beyond which is a wide blackish band, fading into the red of the apical half. Apex fuscous.

FIG. 30. *Spharagemon bolli*. Head and pronotum of female, from side.

	Measurements.			
	Body	Antennæ	Tegmina	Hind Femora
Female	27.5-33	11-13	23 -28	12.5-17
Male	20.5-22	10-13	20.5-25	12.5-13.5

This is our most widely distributed species of the genus, occurring in dry fields and bush-covered areas throughout the state from July until late in October.

S. saxatile Morse.

Rather strikingly marked with brown to blackish fuscous spots or bands on an ash-gray ground. Abdomen more or less yellowish. Face often about equally sprinkled with ash-gray and brown. Antennæ fuscous, darker toward tips, the basal two-thirds with pale annulation. Disk of pronotum usually with faint, ashy colored, X-shaped mark. Tegmina brownish at base with three broad fuscous bands and the tip nearly transparent with numerous dark spots. Inner wings sulphur-yellow at base, the fuscous band broad, reaching to the anal angle, with a broad sub-frontal shoot extending about half-way to the base. Apical third of wing transparent, the tip more (male) or less (female) fuscous. Hind femora ash-gray on outer face with more or less distinct bands of fuscous dots; the inner surface yellow with four blackish bands. Hind tibiæ black at base, a pale ring beyond followed by coral-red. Spurs tipped with black.

	Measurements.			
	Body	Antennæ	Tegmina	Hind Femora
Female	28-34	12-14	25 -31	14 -17
Male	20-24	12-14.5	21.5-25.5	11.5-14

One of our prettiest species, its colors rsembling the lichen-covered rocks of the high, wooded ledges, where it is often abundant. It is a shy insect, quick to take wing, and considerable skill is required to capture it. Canaan, South Kent, Greenwich, New Haven, Deep River, Thompson (A. P. M.); Mt. Carmel, 6 August, Prospect, 15 August, West Rock, 6 October (W. E. B.); Scotland, 10 August, Lyme, 20 August (B. H. W.).

Scirtetica Saussure.

Size small, head rather prominent. Eyes prominent, the occiput elevated. Vertex short, ovate, sloping downward in front. Lateral carina rather high, continuous with the frontal costa which is sulcate throughout, slightly constricted near apex. Lateral foveolæ short, triangular. Median carina faint. Pronotum compressed at the disk, flat, nearly truncate in front with the hind margin obtusely angled. Median carina low, cut a little in front of the middle by a narrow notch. The lateral lobes deeper than long. Tegmina extending considerably beyond the abdomen, contrastingly marked with large spots. Hind wings broad. Hind femora reaching nearly to end of abdomen (female) or surpassing it (male). Hind tibiæ ringed with white, dusky, and coral-red.

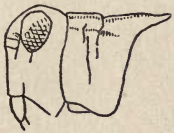


FIG. 31. *Scirtetica marmorata*, female. Head and pronotum, from side.

FIG. 32. *Scirtetica marmorata*, male. Distal part of wing.

S. marmorata Harris. Plate VIII, 10.

The color is extremely variable even in the same locality. The majority of our specimens are ash-color, more or less marked

with fuscous to black. Some specimens occur in which the color is largely fuscous to black, sprinkled with white, yellowish, or reddish. A few specimens have been taken with the ground color pale green. The lower part of the face is usually ashy. Pronotum often with a pale X-shaped mark on disk. The tegmina marbled with grayish and dark blotches. Hind femora grayish, dark at apex and with three fuscous to blackish bands. Wings sulphur-yellow, with a dark, median curved band at base, the apex transparent, tipped with black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	22-25	9.5-10.5	20.5-22.5	10.5-12.5
Male	15-19	10.5-12.5	17 -20	9.3-10.7

This handsome locust will be recognized by the striking marbled markings of the tegmina. It has been taken in but one locality in Connecticut. It occurs in numbers along the sparsely clothed edges of the sand plains at North Haven.

Psinidia Stål.

Head rather large, with the occiput much elevated. The vertex broad posteriorly, the lateral carinæ high, approaching each other rapidly, sloping downward, and continuous with the sides of the frontal costa. The frontal costa sulcate the entire length, very narrow towards the apex, gradually broadened below the ocellus. Antennæ long, the joints strongly flattened and three-sided towards the base. Pronotum much constricted at the middle, the front margin truncate, the hind margin slightly acute-angled. Median carina sharp, of even height throughout, cut twice in front of the middle. Lateral carina sharp and distinct on metazona. Sides of the pronotum deeper than long. Tegmina narrow, extending beyond the end of the abdomen in both sexes. Many of the cells in the middle third are two to four times as long as wide (Fig. 33). Towards the apex the maculations are confined to the marginal area. Inner wings with the disk yellow to orange, median band broad. Hind femora reaching nearly to the tip of the abdomen in the female, surpassing it in the male.

FIG. 33. *Psinidia fenestralis*, male. Distal part of wing.

P. fenestralis Serville. Long-horned Locust.

The general color of this species is influenced largely by the environment and varies from pale buff to reddish brown or even to black. Face and cheeks grayish or yellowish, the top of head and disk of pronotum darker. A narrow yellowish stripe extends back from the eye onto the disk of the pronotum, bordering the lateral carinæ. Tegmina yellowish to dark, the lower or outer half mottled with light and dark, the upper half unspotted. Wings with the basal third varying in different specimens from pale whitish yellow to orange or vermilion red, bordered with a broad black band reaching nearly to the base. Apex transparent. Hind tibiæ dirty gray or with bands of black and whitish.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	19-25	10 -12	17.5-24	11-13.5
Male	15-17.5	10.7-12.3	15.5-20	9-11.7

Inhabits sandy areas throughout the state. It occurs along the seashore, often in company with *Trimerotropis maritima*.

Trimerotropis Stål.

Medium sized, body compressed, head wider than the prozona but less than the width of the metazona. Vertex longer than broad, narrowed gradually towards apex. The lateral carinæ continuous with those of the frontal costa. Median carina, if present, faint. Lateral foveolæ small, triangular. Frontal costa narrowed above and below the ocellus, and in our species sulcate at least on the lower two-thirds. Antennæ filiform. Pronotum with the disk flattened, often with small tubercles on the metazona, the front margin about truncate, and the rear margin with the angle acute to obtuse. Median carina low, cut in front of middle with two notches. Lateral carinæ rounded, indistinct.

Tegmina extending much beyond the abdomen in both sexes, nearly plain or sprinkled with dots. Inner wings with disk pale yellowish, a rather narrow dark band with the apical third transparent. Hind femora of moderate size.

T. maritima Harris. Plate IX, 3.

Size rather large. Pronotum with the median carina low. The lateral carina extremely variable. Metazona about twice the length of the prozona, the disk flat, often with numerous minute tubercles, the hind margin obtusely angled. The color varies from almost white to reddish brown mottled with fuscous blotches. Tegmina usually considerably mottled basally, rarely with traces of transverse bands. Hind wings with the disk very pale yellow with a narrow fuscous band, the width less than one-sixth the length of the wing. A sub-frontal shoot extending about half-way to the base. Apex of the wing transparent. Inner surface of hind femora pale, with traces of three dark bands; the outer surface not distinctly banded. Hind tibiæ yellowish, spines tipped with dark.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	28-35	11.5-14	29-35	14.5-16.8
Male	20-25	11 -13	23-27	11.5-14.5

Common along the sandy seashore of the state. Morse has taken this species at North Haven, and states that this is the only locality that he knows of where it is found away from the sound of the surf.

Circotettix Scudder.

Body compressed. Eyes rather prominent. Vertex ovate, the lateral carinæ rather sharp, continuous with those of the frontal costa. Median carina very faint. Pronotum compressed in front of middle with the disk flat, the posterior margin about right-angled (female) to acute (male). Median carina low on the metazona, higher on the prozona, and cut twice before the middle. Lateral lobes of the pronotum much deeper than long. Lateral carinæ present on the metazona. Tegmina longer than the body, of equal width throughout. Hind wings with the

radial area expanded, and with about three of the radial veins thickened. The disk yellow; a rather narrow, dark median band widening posteriorly, with a triangular sub-frontal shoot reaching about two-thirds the distance to the base of the wing. Hind femora small, not surpassing the end of the abdomen in either sex.

C. verruculatus Kirby. Plate VIII, 11.

Usually the darkest colored of our locusts. Ash-gray thickly mottled with brownish black; darkest on head and pronotum. Antennæ slender, annulated with white. Tegmina with the dark mottlings more or less arranged in cross bands, the venules on the lighter portions often white. Hind femora grayish with four dark cross bars, hind tibiæ grayish white with the apex dusky and a dusky band on the basal third.

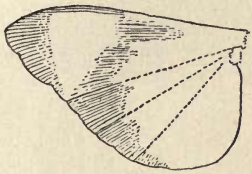


FIG. 34. *Circotettix verruculatus*, male. Wing.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	26-30	10-11.5	24 -28.5 (usually 27-28)	13-14
Male	21-23	9-11.5	20.5-25 (usually 23-24)	11-11.5

This handsome locust is found in the northern portion of the state on high elevations along bare ledges, where it delights to sun itself, its color harmonizing with the gray of the rocks and lichens. It is a shy insect and a ready flier. It may be readily recognized by its "song," which is louder than that of any other of our locusts, and is a series of sharp clicks or snaps instead of a continuous rattle. Canaan (A. P. M.); Colebrook, 21 July (H. L. V.).

ACRIDINÆ.

The species of this sub-family occurring in Connecticut are readily distinguished by the presence of a distinct spine or tubercle on the prosternum between the legs of the front pair. The head is smaller and less swollen than in the two preceding sub-families, and the face (in our species) is nearly perpendicular. The disk of vertex is never depressed, the lateral carinæ are low, rounded, or often absent. Foveolæ often wanting or indistinct. The disk of pronotum without tubercles or wrinkles, the hind margin usually broadly rounded but never acute-angled. Median carina low, sub-equal throughout, lateral carinæ usually rounded or obsolete. Tegmina are present in our species, and, while usually well developed, are in a few species very short. The inner wings usually transparent, not bright colored. The prevailing color of most of the species of this sub-family is dull olivaceous brown, though some are mottled with delicate colors, yellow, green, reddish, or purple.

Among the *Acridinæ* are the most abundant and injurious insects of the whole order. Nearly all of the species pass the winter in the egg stage and begin to reach maturity in early June, though most species are not common until July. "The males of the *Acridinæ* rarely stridulate, and then only when at rest, by rubbing the inner surface over the outer surface of the tegmina."

Key to Genera.

1. Size small, tegmina not over 25 mm. in length. Lobes of mesosternum transverse or equally long and broad. The inner margin usually rounded..... 2
   Size larger, tegmina 27 mm. or more in length. Lobes of mesosternum longer than broad, the inner margin straight .....**Schistocerca** p. 107
2. Color usually dull, largely brownish or olivaceous. Vertex at its narrowest point between the eyes more than twice the width of the second antennal joint. Sub-genital plate of male without a sub-apical tubercle 3
   General color when fresh bright pale green, with a conspicuous narrow purple mid-dorsal line generally on the head, extending across the pronotum and the

dorsal part of the closed tegmina. Vertex at its narrowest point between the eyes less than one and one-half times the width of the second antennal joint. Sub-genital plate of male with a more or less distinct sub-apical tubercle ..... **Hesperotettix** p. 110

3. Dorsal surface of pronotum never twice as long as the average breadth, generally only one and one-half times the breadth, the sides more or less constricted at the middle. Antennæ of male less than twice the length of the pronotum. Sub-genital plate of male rounded apically ..... **Melanoplus** p. 111

Dorsal surface of pronotum twice as long as the average breadth, sides not constricted at middle. Antennæ of male at least twice the length of pronotum. Sub-genital plate with the apex truncate..... **Paroxya** p. 122

Schistocerca Stål.

Size large. Vertex with the front sloping down. Lateral carinæ low, faint; median carina absent. Lateral foveolæ minute or absent. Face nearly vertical. Pronotum with the disk rounded on the prozona, nearly flat on the metazona, truncate in front, hind margin broadly rounded or in some males obtusely angled. Median carina present, but low. Mesosternal lobes longer than broad. Tegmina extending much beyond the abdomen. Hind wings large, nearly transparent. Hind femora slender, usually reaching to or surpassing end of abdomen. Last abdominal segment of male not swollen.

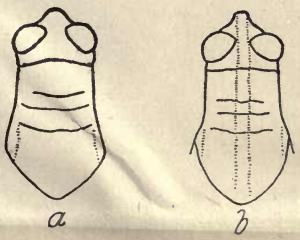


FIG. 35. *a. Schistocerca rubiginosa*, male. *b. Schistocerca alutacea*, male. Head and pronotum.

Key to Species.

1. Size very large. Tegmina 42 (male) to 55 (female) mm. ..... **americana**
   Size smaller. Tegmina 27 (male) to 40 (female) mm. 2
2. General color yellowish brown to olive green, with a mid-dorsal stripe on head, pronotum, and closed tegmina. Vertex prominent ..... **alutacea**
   General color rusty brown, without mid-dorsal stripe as above. Vertex less prominent ..... **rubiginosa**

S. americana Drury. American Locust. Plate IX, 4.

This locust will be readily recognized by its size and conspicuous markings. The female is often two inches or more in length. Antennæ but little if any longer than the head plus pronotum. The color reddish brown, tinted slightly with vermilion. A broad median yellowish stripe extends along the head, pronotum, and closed tegmina as far as the end of the abdomen. A dark brown line from the eye extending down the cheek. Lateral lobes of pronotum with a wide yellow stripe on upper third and with a short narrow stripe below. Tegmina semi-transparent apically with numerous large brownish black spots. Lower margin yellowish at base. Wings transparent. Hind femora buff to brownish with one or two dark streaks along the upper third.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	48-55	13-15	50-55	28-30
Male	39-42	12	42-44	23-24

A female of *Americana* was taken at Hamden, 23 August 1909 (B. H. W.), in a dry field covered with blackberry vines and weeds. This is probably the first Connecticut record for this species. It is found occasionally in the vicinity of New York City, and it should be looked for in the southwest portion of the state from early May until the first of July, and from September to November.

S. alutacea Harris. Leather-colored Locust. Plate IX, 5.

Size rather large, the female much larger and more robust than the male. Vertex rather prominent, narrow; disk but little

depressed (Fig. 35b). Antennæ about one and one-half times head plus pronotum. Median carina low but distinct. Tegmina surpassing the end of the abdomen about one-fourth their length. Hind femora slender, reaching the end of the abdomen (female) or slightly surpassing it (male). Color yellowish brown to a dirty olive green. A bright yellow mid-dorsal stripe on head, pronotum, and closed tegmina. Tegmina sometimes unspotted but usually with dusky blotches. Inner wings yellowish with darker veins. Hind femora yellowish, hind tibiæ olive green, spines yellowish tipped with black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	42-50	14.5-17.5	36-42	22.5-27
Male	28-32	15-17	24-30	17.5-19.5

Occurs on coarse grass and weeds in moist meadows and swamps. Deep River, North Haven, Stamford (A. P. M.); Scotland, 11 August, New Haven, 25 August to October (B. H. W.).

S. rubiginosa Harris-Scudder. Rusty Locust. Plate IX, 6. Size about the same as *alutacea.* Head and pronotum wider than in *alutacea,* vertex wider and less prominent (Fig. 35a). Antennæ of male about one and one-third times head plus pronotum (somewhat longer than in *alutacea*). Color uniform rusty brown to dirty gray. No median yellow stripe on head and pronotum. Tegmina usually with numerous dusky blotches. Wings transparent, glassy, yellowish, slightly rounded towards tips.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	39-54	14-16	32-41	20.5-24
Male	28-33	13-14.5	25-30	16 -19

This species is rather more widely distributed than *alutacea.* It prefers drier locations, and is found in bush-covered areas on light soil, dry pastures, along railroad embankments, etc. This species is considered synonymous with *alutacea* by Rehn,* but most specialists prefer to consider them distinct. Thompson,

* Entomological News, XIII, p. 89, 1902.

Deep River, New Haven, North Haven, Stamford, Greenwich (A. P. M.); Westville, 7 August, 19 October, Granby, 7 October (W. E. B.); West Rock, 29 October (E. J. S. M.); Yalesville, 19 October (H. L. V.); Canterbury, Plainfield, 14 August (B. H. W.).

Hesperotettix Scudder.

Size small, sides subparallel, but little compressed. Head small, vertex between the eyes very narrow with a slight central groove or depression. Face but little oblique, frontal costa narrow and sulcate throughout. Antennæ slightly (female) to considerably (male) longer than the head and the pronotum together. Pronotum long and rather narrow, the prozona about one and one-half times the length of the metazona. The sides of the disk sloping or rounded forming an angle with the lateral lobes. Median carina low, cut by single sulcus. Hind margin broadly rounded or very obtusely angled. Tegmina (in our species) much shorter than the abdomen. Fore and middle femora of male swollen, the hind femora extending much beyond the tip of the abdomen. Sub-genital plate of male with a more or less distinct tubercle near the apex.

H. brevipennis Thomas.

This is one of the most delicately colored of our locusts. General color a pale green. The pronotum with a conspicuous mid-dorsal purplish stripe which is often present on the head. The dorsal surface of the closed tegmina usually largely purple. Antennæ pinkish. Pronotum with a black bar on the upper third of the lateral lobes. Fore and middle femora and the upper face of the hind femora reddish. Outer face of the hind femora with more or less dark. Hind tibiæ pale green to bluish green; spines tipped with black. Tegmina not reaching tip of abdomen in either sex.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	20-24	6.3 -7.2	9.7-11.7	11.8-12.7
Male	15-17	7.25-8.5	7.6-10	9.5-10.5

This species has not yet been recorded from Connecticut, but has been taken in Massachusetts at Wellesley and Walpole, in New Jersey, and in Georgia. The season in which the adult

appears is quite short; the Massachusetts specimens were taken between July 10th and August 30th. It occurs on thin gravelly soil sparsely covered with bunch-grass and running blackberry vines.

Melanoplus Stål.

Body moderately stout, usually feebly compressed. Head not prominent. Face nearly vertical. Vertex between the eyes but little wider than the frontal costa, sloping downward in front, more or less sulcate, especially in the male. Frontal costa moderately prominent, usually sulcate below. Antennæ slender, less than twice the length of the pronotum. Pronotum with the disk generally about one and one-half times as long as broad, the front margin truncate and the posterior obtuse. The prozona slightly convex, the edges parallel, longer than the metazona, which is flat and more or less widened posteriorly. Lateral lobes nearly vertical, the upper half with a more or less distinct transverse dark band. Tegmina always present, in some species but little longer than the pronotum, oval or lanceolate, in others, reaching nearly to or surpassing the tips of the hind femora. Wings consisting of mere scales, or well developed, transparent, colorless. Hind femora moderately long and slender, reaching to the end of the obdomen in the female, surpassing it in the male. Cerci and furcula of male of variable form, furnishing characters much used in the identification of the species. The members of this genus cause much injury to agricultural crops. Fall plowing will destroy many of the egg-masses, one of which is shown in Fig. 36.

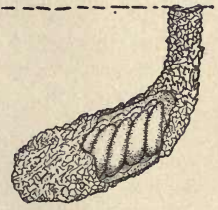


FIG. 36. Egg-mass of *Melanoplus* sp.

Key to Species.

Males.

1. Tegmina at most but little longer than the pronotum (Fig. 38) 2
   Tegmina much longer than the pronotum 3
2. Cerci slender, clasp-like, about four times as long as the breadth at middle (Fig. 38). Furcula well developed but short. Median carina of pronotum indistinct on the prozona .....**mancus**
   Cerci broad, sub-triangular, less than three times as long as the breadth at middle (Fig. 38). Furcula usually very short. Median carina of pronotum distinct throughout .....**scudderi**
3. Cerci not broadened apically, of about uniform width or tapering towards the apex 4
   Cerci irregular in shape, broadened apically or forked 6
4. Apex of sub-genital plate not notched. Cerci long, three or more times the breadth at middle..... 5
   Apex of sub-genital plate with a median notch. Cerci short, not longer than twice the breadth at middle, and nearly equal throughout (Fig. 40a) .....**atlanis**
5. Furcula much longer than the last abdominal segment to which it is attached. Cerci tapering, the apical half less than one-half as broad as the extreme base (Fig. 42a) .....**femur-rubrum**
   Furcula short, no longer than the last abdominal segment to which it is attached. Cerci nearly straight, and of nearly uniform width throughout (Fig. 44a) **fasciatus**
6. Cerci either distinctly forked or with a sub-median angulation 7
   Cerci with the apical half much enlarged, but not distinctly forked 8
7. Lower fork of cerci merely an angle or median process (Fig. 45a). Furcula consisting of slender spines..**minor**
   Cerci distinctly forked, the lower branch narrower (Fig. 46a). Furcula consisting of short triangular lobes .....**luridus**

8. Cerci roughly sock-shaped (Fig. 47). Hind femora robust, not transversely dusky-banded. A large robust species with unspotted tegmina.....**bivittatus**

Cerci terminating in a transverse, oval, tumid lobe (Fig. 48a). Hind femora slender, transversely banded. A medium-sized species with the tegmina more or less distinctly spotted.....**punctulatus**

*Females.**

1. Tegmina at most but little longer than pronotum (Fig. 38) **2**

Tegmina much longer than the pronotum..... 3

2. Interspace between mesosternal lobes usually distinctly transverse. Mid-carina usually obsolete or faint on prozona. Lateral lobes of pronotum considerably longer than deep — the lower half very pale, contrasting strongly with the dorsal half. Tegmina shorter than pronotum, sub-oval (Fig. 38).....**mancus**

Interspace quadrate. Median carina of pronotum conspicuous, equally developed throughout. Lateral lobes about as deep as long, their surface dark brown. Tegmina sub-lanceolate, tapering towards apex, about twice as long as wide (Fig. 38).....**scudderi**

3. Large, robust; hind femora 16 mm. or over (usually 18-19). Dorsal area of closed tegmina separated from lateral area by a pale streak which sometimes suffuses entire dorsal area .....**bivittatus**

Smaller species; hind femora not over 14 mm..... 4

4. Lower valves of ovipositor about straight, the lateral tooth nearly or quite obsolete (Fig. 48b). Interspace between mesosternal lobes transverse. Tegmina dusky-spotted. Hind femora conspicuously banded on outside and cherry-red within at base.....**punctulatus**

Lower valves of ovipositor with the apex more or less distinctly decurved and with a distinct lateral tooth midway of the lower outer margin..... 5

5. Interspace between mesosternal lobes longitudinal or quadrate (Fig. 43). Tegmina usually passing the

* Copied from Morse.

hind femora, the body relatively slender. The pronotum when seen from sides often depressed at principal sulcus, with small, uninflated prozona..... 6

Interspace between mesosternal lobes sub-quadrate or distinctly transverse (Fig. 44b). Species with relatively stout bodies, swollen prozona, and tegmina not passing hind femora 7

6. Prosternal spine nearly cylindrical, the tip bluntly rounded, often bulbous (Fig. 41a). Cerci once and a half times or twice as long as wide, sharply pointed, somewhat acuminate, the sides slightly concave. Ovipositor seen from the side with the basal part of the scoop longer, the angle between the scoop and stem more obtuse (Fig. 42b). Hind tibiæ red. Hind femora largely or wholly lacking transverse dusky bands except on dorsal part of inner face. Mid-carina of pronotum frequently distinct on prozona **femur-rubrum**

Prosternal spine tapering, the tip pointed (Fig. 41b). Cerci shorter, only about one and one-third times as long as wide, rather dull at tip, the sides straight or often convex. Upper valves of ovipositor with scoop shorter, the angle at junction with stem more pronounced (Fig. 40b). Hind tibiæ either glaucous or red. Hind femora usually with conspicuous, dusky, oblique bands. Median carina of pronotum seldom distinct on prozona..... **atlanis**

7. Tegmina about reaching end of hind femora. Interspace but little transverse 8

Tegmina reaching but one-half to two-thirds the length of the hind femora. *Interspace rather strongly transverse (Fig. 44b).* Very little angulation at junction of scoop and stem of ovipositor ..... **fasciatus**

8. Scoop of ovipositor very short, deeply concave, with a single denticulation or none at base of outer edge; lower valves with the tips correspondingly short and decurved (Fig. 45b). Hind tibiæ usually glaucous but often red. Tegmina flecked with dusky and pale spots, hind femora obliquely banded. Lateral carinæ of pronotum usually bordered below on the prozona

by a broad fuscous stripe which is crossed obliquely by a distinct, narrow, pale line. Prozona less inflated than in *luridus* and body less robust .....**minor**

Scoop rather long, the outer edge of basal half rather deeply notched, crenulate-denticulate, the tips of both pairs of valves long and evenly tapering (Fig. 46b). Hind tibiæ coral-red. Fuscous stripes on prozona indistinct, often lacking. Tegmina maculate and hind femora obliquely banded. A robust species, with noticeably tumid prozona and thick-necked aspect .....**luridus**

M. mancus Smith.

Size rather small. Eyes somewhat prominent, especially in the male. Tegmina shorter than the pronotum, sub-ovate, broadly rounded at the apex. Color dark fuscous above, lighter below. Lateral lobes of the pronotum crossed on the upper half with a distinct, broad, dark band. Pronotum with the lateral lobes contrastingly marked, pale below with a distinct broad dark band above, which is widened posteriorly. It is often lighter but never absent on the metazona. Hind femora without distinct cross bands. Hind tibiæ red, often pale towards base, the spines black, 10 or 11 in the outer row.

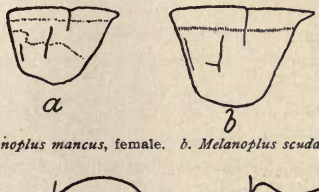


FIG. 37. *a. Melanoplus mancus*, female. *b. Melanoplus scudderi*, female. Lateral view of pronotum.

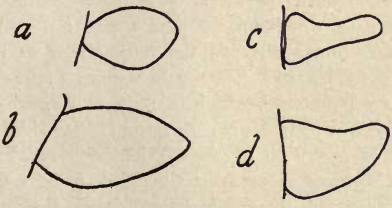


FIG. 38. *a. Melanoplus mancus*, female. *b. Melanoplus scudderi*, female. Tegmina. *c. Melanoplus mancus*, male. *d. Melanoplus scudderi*, male. Cerci.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	18-25	6.5-7	3-5	10-12
Male	14-17.5	6.5-7	2-4	8.3-9

This species is ordinarily rather common locally on some of the mountains of the northern New England states at altitudes of 2,000-3,500 feet. It has, however, been taken in Connecticut at North Madison and at Woodbridge, the latter part of August, by Professor W. S. Blatchley. At the former place he mentions it as being numerous on high ledges along the Hamanasset River.

M. scudderi Uhler. Scudder's Short-winged Locust. Plate IX, 7.

Size rather small. Tegmina about as long as pronotum, ovate-lanceolate in shape. Their inner edges just about touching in the male, slightly overlapping in the female. Wings less than half the length of the tegmina. Color dull reddish or wood-brown. The males and sometimes the females with an indistinct dusky bar reaching from the eye back along the upper half of pronotum to the metazona. Hind femora with two faint dark bars on their upper surface, the apex blackish. Hind tibiæ red, sometimes dull at base. Spines black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	17-24	6 -7	5-8	11-13
Male	15-18	6.5-7	4-5.5	10-11

This species is rather common the latter part of the season in open places in bushy pastures, on hillsides, or in open places along the edge of woodland. Morse found it "quite plentiful along the rocks and bushes on the talus slopes at the foot of West Rock, New Haven." The only species that *scudderi* will be mistaken for is *mancus*, which is apparently much more local and ordinarily frequents higher elevations. It will probably be often taken for a nymph of some other species of the genus. The nymphs, however, differ from the adults in having the wings and tegmina reversed, the wings appearing on the outside.

M. atlanis Riley. Lesser Migratory Locust. Plate X, 1.

Size medium. Vertex somewhat elevated above the pronotum. Median carina distinct only on the metazona. Tegmina surpassing the end of the hind femora. Color dark grayish or reddish brown. The dark band behind the eye is present on the prozona only, and is often more or less broken into spots, especially in the female. Tegmina distinctly spotted with fuscous along the discoidal area. Hind femora yellowish brown with two oblique dark bands on the upper and outer faces (more distinct than in *femur-rubrum*). Sides and under surface of abdomen yellowish (in *femur-rubrum* it is usually reddish brown).

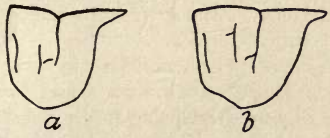


FIG. 39. *a. Melanoplus atlanis. b. Melanoplus luridus.* Lateral view of female pronotum.

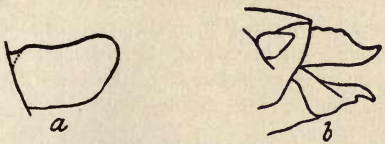


FIG. 40. *Melanoplus atlanis. a.* Cercus of male. *b.* Ovipositor of female.

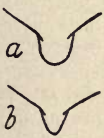


FIG. 41. *a. Melanoplus femur-rubrum. b. Melanoplus atlanis.* Prosternal spine of female.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	16-27	6.5-8	14.5-22	10-14
Male	17-21.5	7 -8.5	15 -21	10-13

"This species is found over the whole of New England from Nantucket to Canada, from the seashore to the alpine tops

of the White Mountains." From various parts of the state, 18 July to 30 October.

M. femur-rubrum DeGeer. Red-legged Locust. Plate IX, 8.

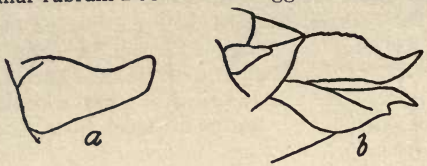


FIG. 42. *Melanoplus femur-rubrum*. *a*. Cercus of male. *b*. Ovipositor of female.

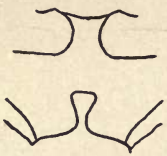


FIG. 43. *Melanoplus femur-rubrum*, female. Meso- and metasterna; interspace longitudinal.

Medium-sized. Pronotum with the median carina distinct on both the metazona and the prozona. Tegmina usually surpassing, at least slightly, the tips of hind femora; distinctly but very gradually tapering. Color reddish brown to dark olive brown. Occiput usually with a pair of widening fuscous stripes on its sides. Pronotum with the disk generally darker than the lower half of lateral lobes. The usual dark band on the upper part of the lateral lobes of the prozona, often inconspicuous in the female. The top of the occiput and disk of the pronotum often rose-red, and the lower part of the face and lower parts of lateral lobes yellowish green. Tegmina brownish fuscous, sometimes immaculate, but usually with fuscous dots along the basal half of the discoidal area. Hind femora reddish brown clouded with fuscous which often forms two oblique cross-bars on the upper face. Lower inner face dull yellowish or orange. Hind tibiæ almost always deep red, very rarely yellowish green. Spines black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	18-28	6.5-9	15.5-23	11 -15
Male	16-23	6.5-10	13 -20	10.7-13.3

This is our most common as well as our most injurious species of locusts, and is found all over the state from the last of July until after frost. It is especially abundant in moist meadows and places where the grass is thick and succulent.

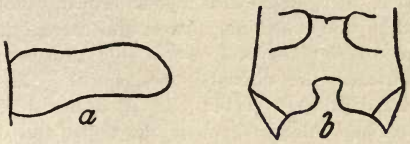


FIG. 44. *Melanoplus fasciatus*. *a*. Cercus of male. *b*. Meso- and metasterna of female; interspace transverse.

M. fasciatus Barnston-Walker.

Size medium, a rather thick-set species. Head with the vertex somewhat raised. Tegmina covering about one-half (female) or three-fourths (male) of the abdomen. Color variable, dark reddish brown to dark olivaceous gray. Yellowish below. A dark band from the back of the eye extending along the upper part of the lateral lobes of the pronotum to the metazona. Tegmina often with fuscous spots along the discoidal area. Hind femora brownish yellow, blackish at apex and base, and with two broad, oblique, blackish bars on the outer face. Pale or dull red on the inner faces. Hind tibiæ usually red, pale towards base, occasionally a smoky greenish color. Spines black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	16.5-25.5	6.5-8.5	9 -12.	10.7-12.7
Male	16 -19	7.5-9	7.9-10	9.3-10.7

This species occurs in dry, uncultivated fields and pastures, especially among bush-covered areas. Thompson (A. P. M.); New Haven, 13 June — 23 August; Lyme, 21 August.

M. minor Scudder.

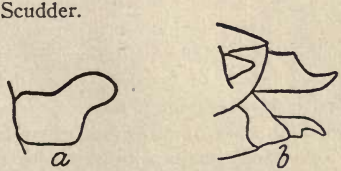


FIG. 45. *Melanoplus minor*. *a*. Cercus of male. *b*. Ovipositor of female.

Size medium. Eyes quite prominent and rather widely separated. Pronotum short. Tegmina reaching about to the tips of the hind femora, a little shorter in the female, sometimes slightly surpassing them in the male. Color dark brownish fuscous above, often tinged with reddish brown, yellowish below. The bar behind the eye shining black, and extending across the upper third of the lateral lobes of the prozona. Tegmina brownish fuscous, the discoidal area more or less distinctly marked with dark spots. Hind femora brownish yellow with indistinct, oblique, fuscous bars on the upper and outer faces. The lower face generally dull orange. Hind tibiæ variable, pale red, sometimes yellowish or lead-color.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	19-24	7 -8	13.5-18	12-13.5
Male	15-18-5	6.7-7.5	11 -15	10-11

This is the earliest species of *Melanoplus* to appear, reaching maturity early in June. Morse states that he has found it most numerous among sweet vernal and blue grasses (*Anthoxanthum odoratum,* and *Poa pratensis*) in pastures and mowing-lands on gravelly or sandy upland soils.

M. luridus Dodge. *M. collinus* Scudder.

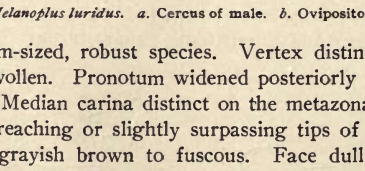


FIG. 46. *Melanoplus luridus. a.* Cercus of male. *b.* Ovipositor of female.

A medium-sized, robust species. Vertex distinctly elevated, somewhat swollen. Pronotum widened posteriorly with the disk nearly flat. Median carina distinct on the metazona only. Tegmina about reaching or slightly surpassing tips of hind femora. Color dark grayish brown to fuscous. Face dull bluish gray. Top of head and disk of pronotum fuscous. The black bar on upper half of lateral lobes of pronotum often faint, especially in the female. Tegmina usually sprinkled with fuscous. Hind

femora brownish yellow with oblique bars of fuscous on the upper face; dull orange or yellow below; knees black. Hind tibiæ coral-red. Spines black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	19.5-27.5	7.5-9.5	14 -19	11.5-15
Male	16.5-20	7 -9	10.7-16.5	10 -12.5

Found on dry soils, especially near the edges of woodland. From various parts of the state from the 20th July throughout the season.

M. bivittatus Say. Yellow-striped Locust. Plate X, 2.

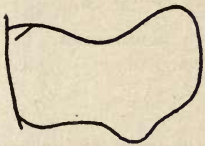


FIG. 47. *Melanoplus bivittatus.* Cercus of male.

Our largest species of *Melanoplus.* Median carina of pronotum low but distinct throughout. Tegmina reaching or surpassing the end of hind femora, often shorter in the female, tapering gradually. Hind femora rather long and somewhat stout. Color variable, olive brown to light greenish yellow above, yellowish beneath. A narrow yellowish stripe extends back from the upper angle of each eye along the lateral carinæ of pronotum nearly to the tips of the tegmina. Tegmina with scattering dots of fuscous along the anal angle, often unspotted. Hind femora dull yellow with more or less dark on the upper half of the outer face. The lower face yellow, the apex dusky. Hind tibiæ bright red to purplish. Spines black.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	29-40	9.6-14	19.5-26	15.5-22
Male	23-29	14 -16	16 -22	12.5-16.5

This is a common species occurring everywhere in New England. It is found from the latter part of June until the end of the season.

M. punctulatus Uhler. Grizzly Locust.

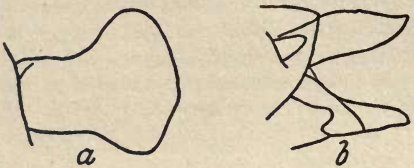


FIG. 48. *Melanoplus punctulatus*. *a*. Cercus of male. *b*. Ovipositor of female.

Size medium. Head prominent, vertex swollen and distinctly elevated above the pronotum. Median carina usually distinct throughout, but more prominent on the metazona. Tegmina slightly surpassing the hind femora in both sexes, tapering gradually, the apex rounded. Color dark gray mottled with blackish, clay-yellow beneath. Head and face often with a greenish cast. The black on upper part of the lateral lobes of pronotum broken and more or less indistinct. Tegmina thickly sprinkled and mottled. Hind femora yellowish banded with blackish. The lower face and basal third of inner face coral-red. Hind tibiæ red or gray, or a mixture of both. Spines black. A handsome species.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	23-29	10.5-12	14.5-21.6	11.3-12.7
Male	19-20.5	11 -13	14 -16.8	10 -11

This species usually occurs in the vicinity of pine trees, and is often found clinging to the trunks and branches. Canaan (A. P. M.); West Woodstock (W. B); New Canaan, 9 October (W. E. B.); Windsor, 13 September (B.H.W.).

Paroxya Scudder.

Size medium. Body straight and nearly cylindrical. Head moderately large. Eyes large and prominent. Vertex narrow but wider than in *Hesperotettix*. Frontal costa prominent above the ocellus, punctate and but slightly sulcate. Antennæ long, usually more than one and one-half times the length of the head and pronotum together. Disk of pronotum about twice as long as the average width, the edges sub-parallel, at least in the male,

and with the surface nearly flat. The prozona longer than the metazona, the latter with the hind border obtusely angled. Median carina low, but distinct and equal throughout. Lateral lobes vertical, longer than deep. Tegmina and wings variable, covering about three-fourths of the abdomen in our species. Hind femora moderately stout, tapering gradually and surpassing tip of the abdomen. Sub-genial plate of male short. Cerci long and incurved apically.

P. floridana Thomas. Plate X, 3.

General color olivaceous. Top of head, pronotum, and tegmina varying from light to dark brown. Face yellowish. Antennæ brownish, annulated with light. A dark brown bar from the posterior border of the eye extending back along the upper edge of the lateral lobes of the pronotum and often ending abruptly at the metazona; below this band often yellowish. Fore and middle legs and hind tibiæ often bluish green. Outer face of hind femora without transverse bands, brown-green or yellowish on lower face.

Measurements.

	Body	Antennæ	Tegmina	Hind Femora
Female	26-36	8.5-11	14.5-20	15.3-18.7
Male	20-25	13 -15	13 -16	12 -13.5

Rather common in the tall grasses and sedges along the edges of swamps and low lands. An active insect, but one which usually tries to escape attention by slipping around to the opposite side of the stem to which it clings. Morse has taken it as early as the 22d of July; our latest record is the 14th of October. Deep River, North Haven, Niantic, Stamford (A. P. M.); Branford, 3 September (H. L. V.); New Canaan, 21 September, New Haven, 25 August, Westville, 7 September, Wallingford, 14 October (B. H. W.).

LOCUSTIDÆ.

The family *Locustidæ* includes the insects commonly known as katydids, green or long-horned grasshoppers, and camel-crickets. They are readily distinguished from the *Acrididæ* by the slender, many-jointed antennæ which are much longer than the body, the tarsi or feet which are four-jointed in the Con-

necticut *Locustidæ*, and the ovipositor which is sword-shaped. The ocelli are usually wanting.

The mouth-parts are well developed, with long, pointed mandibles. The stridulating or musical organ of the male is situated at the base of the tegmina. Each tegmen is furnished with a small transparent area, the upper one being crossed by a vein with minute, file-like teeth on the under side. The sound is made by rubbing these teeth on the upper side of the lower wing cover. Each species of *Locustidæ* has a distinct note by which it is possible to distinguish it, and many have two calls, one of which they use during the day and the other at night. The ear of the katydid, when present, is situated on the front leg near the basal end of the tibia, and consists of an oval cavity covered with a transparent membrane.

In the length of the antennæ, the structure of the organs of sound, and the auditory organs, the *Locustidæ* resemble the following family, *Gryllidæ;* but the former differ in having the sword-shaped ovipositor, and in the wing covers which slope obliquely downward at the sides, while in the *Gryllidæ* the wing covers are more flat dorsally, and are bent down over the sides of the abdomen at nearly right angles.

There are six sub-families of *Locustidæ* occurring in the United States, five of which are represented in Connecticut.

Key to Sub-families.

1. Tegmina and wings present 2
   Tegmina and wings absent, or the former rudimentary 4
2. Prosternal spines present; vertex terminating in a sharp, flat spine, or produced upward and forward in a rounded tubercle or prominent cone; hind tibiæ without apical spines or with one on outer side only 3
   Prosternal spines absent; vertex rounded or deflexed, without spine, tubercle, or cone; tegmina always shorter than wings; hind tibiæ with an apical spine on each side .....PHANEROPTERINÆ p. 125
3. Wing covers leaf-like, broadly expanded in the middle, concave within, longer than the wings; vertex terminating in a sharp, flat spine; pronotum crossed by two distinct transverse sulci.....PSEUDOPHYLLINÆ p. 131
   Wing covers narrow, expanding but little if any in the

middle, often shorter than the wings; vertex terminating in a rounded tubercle or prominent cone; pronotum without or with only one transverse sulcus..
CONOCEPHALINÆ p. 132

4. Pronotum extending back to the abdomen; prosternal spines present; fore tibiæ with a hearing organ near the base; tegmina rudimentary.....DECTICINÆ p. 140

Pronotum short, not covering the whole top of thorax; prosternal spines absent; fore tibiæ without a hearing organ near the base. Wholly wingless. Eyes subrounded, situated partly above the basal joints of the antennæ; ovipositor nearly straight.....
STENOPELMATINÆ p. 142

PHANEROPTERINÆ.

This sub-family and the *Pseudophyllinæ* include the insects known as katydids, and here belong our largest species of *Locustidæ*. Head with apex obtuse or rounded, without cone or spine. Prosternum unarmed. The wing covers are of a bright green color and usually expanded in the middle. The wings are large and strong, and extend beyond the wing covers.

The katydids are the most arboreal of all the *Locustidæ,* are solitary in habit, and, while they may be quite numerous and do much injury to the leaves and twigs of shrubs and trees, are seldom noticed.

Key to Genera.

Tegmina of nearly equal breadth throughout, fastigium of vertex no broader than the first antennal joint.....
Scudderia p. 125

Tegmina widened at the middle; fastigium of vertex much broader than the first antennal joint..**Amblycorypha** p. 129

Scudderia Stål.

The katydids of this genus are medium-sized. Head oval, with fastigium of vertex very narrow. Thorax longer than broad. Wing covers long and narrow, of nearly the same width throughout, and rounded at apex. The fore and middle femora unarmed beneath; hind femora long and slender. The short, broad ovipositor is curved sharply upward with the apical third

finely crenulate on both margins. The males usually have the anal plates formed into long, curved processes which readily distinguish them from the other genera of this group. The process from the supra-anal plate curves downward and that from the sub-anal curves upward, and both of them are notched at the ends.

The species of *Scudderia* in general inhabit bushes, tall grass, and weeds, in meadows and along roadsides, especially in damp places.

Key to Species.

1. Supra-anal plate of male with a long decurved process 2
   Supra-anal plate of male triangular, without a long decurved process (Fig. 53) ..... **septentrionalis**
2. Length of posterior femora 28 mm. or more..... 3
   Length of posterior femora less than 25 mm..... 4
3. Notch of supra-anal plate broad, with minute median tooth, the lateral processes slender, the notch as wide as the upturned sub-anal spine, the latter fitting into the notch when in natural position (Fig. 49).... **texensis**
   Notch of supra-anal plate triangular, without a median tooth. Lateral processes broadly rounded. Sub-anal spine touching but not fitting into the notch (Fig. 50) **curvicauda**
4. Notch of supra-anal plate triangular, as in *curvicauda*. Width of tegmina much greater than depth of body (Fig. 51)..... **pistillata**
   Notch of supra-anal plate deep, rounded, forming a fork-shaped appendage with swollen lateral processes. Width of tegmina not greater than depth of body (Fig. 52) **furcata**

S. texensis Saussure-Pictet. Texas Katydid.

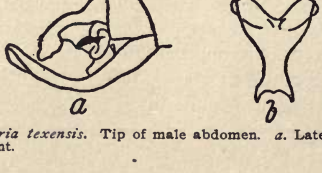


FIG. 49. *Scudderia texensis*. Tip of male abdomen. *a*. Lateral view. *b*. Dorsal view of anal segment.

General color bright green; body and face somewhat lighter. Pronotum much longer than broad, narrower in front than behind, with a yellowish line along the lateral carinæ. Posterior femora very slender, with three or four minute teeth on under side of inner carinæ. Male having notch of supra-anal plate broad, with a minute median tooth.

Measurements.

	Body	Pronotum	Tegmina Length	Tegmina Width	Hind Femora	Ovipositor
Female	24	6.5	34-37	8		7
Male	20-24	6.	33-36	7	26-30	

This species does not seem to be as common as *S. curvicauda* or *furcata* in Connecticut. It is said to be less arboreal than the other species. May be found clinging to tall grasses, weeds, and bushes, especially in damp places. East Hartford, 1 August, Westville, 9 August, New Haven, 21 August to 28 September, Plainfield, 14 September (B. H. W.).

S. curvicauda DeGeer. Curved-tail Katydid. Plate X, 4.

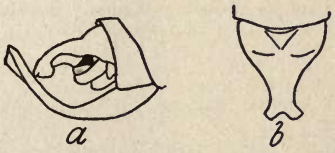


FIG. 50. *Scudderia curvicauda.* Tip of male abdomen. *a.* Lateral view. *b.* Dorsal view of anal segment.

About the same size and general color as *texensis,* though the yellow line on the lateral carinæ is usually absent. It is difficult to distinguish the female from that of *texensis,* but the female of *curvicauda* is usually more robust, with slightly wider wing covers and the ovipositor not as deeply notched. The male is readily distinguished by the notch of the supra-anal plate.

Measurements.

	Body	Pronotum	Tegmina Length	Tegmina Width	Hind Femora	Ovipositor
Female	22-24	6	34-38	8	27	7
Male	22	6	35-38	7	28-30	

This is one of our most common species. New Haven, August and September, Stafford, 24 August (W. E. B.); Scotland, Canterbury, Plainfield, 10-14 August (B. H. W.).

This species, together with *S. texensis,* causes considerable damage on the cranberry bogs in New Jersey. They destroy the berries by eating into them to get the seeds.

S. pistillata Bruner.

FIG. 51. *Scudderia pistillata.* Tip of male abdomen. *a.* Lateral view. *b.* Dorsal view of anal segment.

Species with shorter body and legs and broader wings than *curvicauda.* The notch of the supra-anal plate of the male resembles that of *curvicauda,* but the lateral processes are more triangular in shape.

	Measurements.					
	Body	Pronotum	Tegmina Length	Tegmina Width	Hind Femora	Ovipositor
Female	22	5.5	27.5	9	20	7
Male	18	5.5	33	9.5	22	

Salisbury, 30 August, Stafford, 24 August (W. E. B.).

S. furcata Bruner. Fork-tailed Katydid.

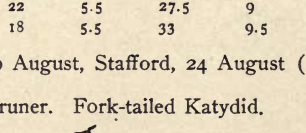


FIG. 52. *Scudderia furcata.* Tip of male abdomen. *a.* Lateral view. *b.* Dorsal view of anal segment.

Our smallest species. Wings narrow and of a dark green color. Lateral carinæ of pronotum more nearly parallel than in the preceding species. The notch of the supra-anal plate of the male is deep and rounded, the lateral processes much swollen.

	Measurements.					
	Body	Pronotum	Tegmina		Hind Femora	Ovipositor
			Length	Width		
Female	18-20	5	26-30	6	20-22	5
Male	16-18	5	28-30	6.5	21	

This is our most common species, occurring throughout the state.

S. septentrionalis Serville.

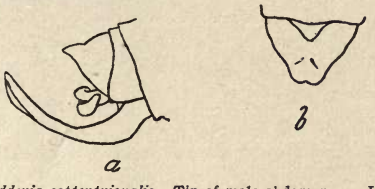


FIG. 53. *Scudderia septentrionalis.* Tip of male abdomen. *a.* Lateral view. *b.* Dorsal view of anal segment.

This species is about the size of *furcata.* Body short, eyes prominent. Pronotum narrower at anterior margin than at posterior. Wing covers rather wide, but not as wide as in *S. pistillata.* Female with the lateral lobes of pronotum broader than deep. Ovipositor long and curved but not sharply bent.

	Measurements.				
	Body	Pronotum	Tegmina		Hind Femora
			Length	Width	
Male	18	5	28	8	19

This species is quite rare. One specimen (a male) was taken in a tobacco-field, Southington, 4 August (B. H. W.).

Amblycorypha Stål.

Head with the vertex flat and without spines; fastigium bent downward, much broader than the first antennal joint; eyes oblong oval. Antennæ long and slender excepting the two basal joints, the first being larger and thicker than the second. Pronotum much longer than broad. Wing covers broad, rounded at apex. Stridulating organ of male brown in color and crossed transversely by a prominent green vein. Male with supra-anal plate short, broad at base, narrowed at apex, and cut by a deep, triangular notch forming two slender, triangular appendages which terminate in short, spine-like processes. Female with

broad, curved ovipositor, rounded at tip, with the apical half deeply serrated on both edges.

Key to Species.

1. Tegmina 34-39 mm. in length, those of the male surpassing the tips of the hind femora.....**oblongifolia**
   Tegmina less than 30 mm. in length, those of the male often reaching but not surpassing the tips of the hind femora .....**rotundifolia**

A. oblongifolia DeGeer. Oblong-leaf-winged Katydid. Plate X, 5.

A large species with bright pea-green wings, abdomen yellowish to brownish green. Stridulating organ brownish, usually with a green patch bordered posteriorly by the prominent green cross vein. Pronotum with anterior portion narrower than posterior, and the lateral carinæ prominent. Lower inner carinæ of posterior femora with six to twelve strong teeth.

Measurements.

	Body	Tegmina		Hind Femora	Ovipositor
		Length	Width		
Female	23	38	11	30	11.5
Male	22	36	11.5	31	

Occurs throughout the state from August until October. Common on low trees and shrubbery, especially in damp places. Its note, which is often heard in late afternoon and during cloudy weather, has been likened to the sound made by drawing a fine-tooth comb over a taut string.

A. rotundifolia Scudder. Round-winged Katydid.

A smaller species, general color pale green, body somewhat lighter. Pronotum, especially in the female, with the anterior portion but little narrower than the posterior portion. Ovipositor more curved and more deeply serrated than in *oblongifolia*. Tegmina proportionately broader than in *oblongifolia*. Posterior femora with four or five teeth on the lower inner carina.

Measurements.

	Body	Tegmina		Hind Femora	Ovipositor
		Length	Width		
Female	20	26-28	10	25	10
Male	19	26	9.5	24	

Less common than the preceding species. New Haven, 25 July to 26 September, Mt. Carmel, 25 September (W. E. B.); Scotland, 27 July, New Haven, 7 August, Lyme, 21 August (B. H. W.).

PSEUDOPHYLLINÆ.

This sub-family is represented in Connecticut by only one genus containing one species.

Cyrtophyllus Burmeister.

Head large and stout, with rather small roundish eyes; vertex compressed by the basal joints of the antennæ, and extending forward between the eyes, forming a small triangular spine, which is grooved above. Prosternum armed with two short spines. Pronotum nearly as wide dorsally as long, and cut by two transverse sulci; surface rugose, with the posterior portion raised above the rest of the pronotum. The tegmina extend beyond the wings and are nearly half as wide as long, obtusely rounded apically and concaved within. Sub-anal plate of male terminating in a long paddle-shaped appendage grooved on the upper side. Ovipositor of female broad, the apical half with minute teeth on the lower edge and curved upward. Apex with a rather sharp point. Stridulating organ prominent, of a brown color, with the central portion sunken and transparent.

C. perspicillatus Linnæus. True Katydid. Broad-winged Katydid. Plate VI, 4.

The true katydid is readily recognized by the broad wing covers, which when closed curve around the body, so that the edges touch above and beneath. The wing covers are dark green in color and thickly netted with prominent veins so that they much resemble leaves. The calling organ is large and well developed, which together with the peculiar shape of the wing covers enables the katydid to produce the loudest note of all our locustids.

Measurements.

	Body	Tegmina		Hind Femora	Ovipositor
		Length	Width		
Female	28	34	16	20	14
Male	31	38	18	21	

This insect is common throughout the state, but is rarely seen, as it frequents the dense foliage of shade-trees and tall

shrubbery. Occasionally it occurs locally in numbers. The writer was attracted to a colony of katydids one cloudy afternoon in a clump of trees near a small pond. Their call notes, which were almost continuous, were heard for quite a distance, and became very loud and discordant upon approach. West Woodstock, September (W. B.); New Haven, 9 August (P. L. Buttrick); New Canaan, 9 September, 5 October (B. H. W.); Mt. Carmel, 25 September, New Haven, 20 October (W. E. B.).

CONOCEPHALINÆ.

Vertex of head projecting upward and forward in the form of a blunt, or sometimes a much prolonged, tubercle or cone. Prosternum toothed or with two slender spines. Apical spines absent on fore tibiæ. Front coxæ with a spine on the outside. Wing covers usually narrow, often shorter than the abdomen, and either green or brown in color. Calling organ of male well developed and with a prominent cross vein.

Key to Genera.

1. Fore and middle femora with spines beneath; vertex extending forward in the form of a long cone; calling organ of male opaque..... **Conocephalus** p. 132
   Fore and middle femora without spines beneath; vertex ending in a round tubercle which is hollowed out at the sides; calling organ of male somewhat transparent 2
2. Insects of small size; prosternal spine very short; ovipositor slender and nearly straight..... **Xiphidium** p. 136
   Insects of medium size; prosternal spines longer and more slender; ovipositor stout and usually upturned **Orchelimum** p. 138

Conocephalus Thunberg.

Head with the vertex extended forward and upward between the eyes and terminating in a long cone which is armed beneath with a basal tooth. Face very oblique. Eyes rather prominent and nearly round. Prosternum with long slender spines. Disk of pronotum flat, narrower in front than at posterior margin. Lateral lobes curved obliquely backward in front and well

rounded posteriorly. Wing covers long and narrow, slightly wider at the base, and rounded at the apex. Stridulating organ of male of same general color as the insect, opaque on the left wing cover, the central portion of the right wing cover transparent. Anal plates of male short, with the cerci swollen, incurved, and toothed.

Key to Species.

1. Vertex with the cone slender, extending at least 3 mm. in front of the eyes..... 2
   Vertex with the cone stouter, extending less than 3 mm. in front of the eyes..... 3
2. Lower face of cone with the apex black (Figs. 54, 55); a black line on either margin extending half-way to the base; inner lower carina of posterior femora with four or five minute spines.....**ensiger**
   Lower face of cone wholly black from the apex to the basal tooth (Fig. 56); both lower carinæ of posterior femora with a number of rather prominent spines **exiliscanorus**
3. Cone of the vertex with the sides tapering; apex usually without black margins, rarely with a narrow black line (Fig. 57).....**robustus**
   Cone of the vertex with the sides sub-parallel; the apex rounded and distinctly tipped with black (Figs. 58, 59).....**triops**

C. ensiger Harris. Sword-bearer. Plate X, 6.

FIG. 54. *Conocephalus ensiger*, male. Dorsal view of vertex.

FIG. 55. *Conocephalus ensiger*, male. Under side of tip of cone

This is our most slender and graceful species. Wings usually bright green, head and body somewhat lighter, usually a yellowish line on the lateral carinæ of the pronotum. Posterior tibiæ and tip of ovipositor smoky brown. Cone of vertex long and slender, usually over 3 mm., rather acutely rounded at apex, a black line on either margin beneath extending from the apex halfway or more to the base. Tegmina long, narrower than in any of our other species. Brown examples of *ensiger* seem to be quite scarce.

Measurements.

	Body	Cone	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	28-30	3.25-3.5	7-7.5	44-48	22	28-31
Male	24-26	3	7-7.5	37-40	20	

Occurs in moist fields and meadows where the grass is tall and coarse, from July to October. Scotland, 27 July to 7 August, New Haven, 11 August to 10 September (B. H. W.).

C. exiliscanorus Davis.

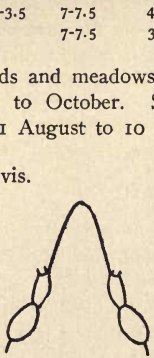


FIG. 56. *Conocephalus exiliscanorus*, male. Dorsal view of vertex.

Somewhat resembles *robustus*, but will be readily recognized by the long cone, the underside of which is black from the tip to the basal tooth.

Measurements.

	Body	Cone	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	40	4	8	43	23	38
Male	34			39	23	

Beutenmüller states that this species is found from the latter part of July until cold weather in the salt marshes and meadows of Staten Island. A female in the collection of the Peabody Museum of Yale University, has the following record: New Haven (D. C. Eaton).

C. robustus Scudder. Plate X, 7.

FIG. 57. *Conocephalus robustus*, male. Dorsal view of vertex.

General color pale green or pale brown, tegmina in the latter case usually sprinkled with small black dots. The cone of the vertex slightly shorter and blunter than in *ensiger*. The apex rarely tipped with black, the basal tooth small and blunt. A yellow line extends from the vertex along the lateral carinæ of the pronotum. Wings of the male as long as the tegmina, those of the female a trifle shorter.

Measurements.

	Body	Cone	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	32	2.5	7.5	46-48	25	25-26
Male	30	2.25	8	40-44	22	

This is the most common species in the vicinity of New Haven. It is found on the salt marsh, along roadsides, and on dry, light soil, especially in the bunch-grass, in the roots of which it is said to deposit its eggs. Its song, which is very loud and much resembles that of the harvest-fly, *Cicada canicularis*, is frequently heard late in the afternoon and during the evening. New Haven, August and September, Scotland, 11 August, Plainfield, 14 August, North Haven, 17 September (B. H. W.).

C. triops Linnæus. Plate X, 8.

FIG. 58. *Conocephalus triops*, male. Dorsal view of vertex.

FIG. 59. *Conocephalus triops*, male. Under side of tip of cone.

Somewhat smaller than *robustus* and rather stouter than *ensiger*. The cone of the vertex is short, with the sides nearly parallel and the front obtusely rounded; the apex beneath distinctly tipped with black. Nearly half of the specimens taken are light brown.

Measurements.

	Body	Cone	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	27-30	2	6.5	30-39	20-22	28-34
Male	24-28	2	7	32-36	18-20	

This species was first taken near New Haven in 1902,* and that was the first record of the occurrence of a native specimen in New England. In 1904 it was fairly common in this vicinity, seven specimens being taken at one time in the tall grass along a ditch which contained water only in very wet seasons. New Haven, 29 August to 3 October, Westville, 19 September (B. H. W.).

Xiphidium Serville.

The insects of this genus are our smallest winged locustids. Head with the face rounded, somewhat oblique, and with rather large roundish eyes. Vertex extends forward and slightly upward in the form of a rounded tubercle. Prosternal spines very short and weak. Tegmina narrow and straight, the length variable, but usually shorter than the abdomen. Wings usually not reaching the tips of the tegmina. Calling organs of male well developed, light brown in color, the middle transparent. Hind femora swollen at base, of medium length. Ovipositor slender, nearly straight, rarely slightly upcurved. Cerci of male swollen, with a basal tooth on the inner margin. The length of the wings and the color are quite variable in the members of this genus.

Key to Species.

1. Ovipositor shorter than the body..... 2
   Ovipositor as long as the body.....**ensiferum**
2. Body very slender, wings slightly exceeding the tegmina, which are fully developed and longer than the abdomen **fasciatum**

* *Psyche*, Vol. XI, p. 23, 1904.

Body stouter, wings usually shorter than the tegmina. Tegmina usually not reaching tip of abdomen.... **brevipenne**

X. fasciatum DeGeer. Slender Meadow Grasshopper. Plate X, 9.

This pretty little species is one of our most slender-bodied locustids. The following parts are green: face, sides of pronotum, sides of abdomen, legs (excepting knees and tarsi), and base of ovipositor. A broad, dark, reddish brown, longitudinal stripe on occiput and pronotum. The tegmina, the abdomen above, and apical third of ovipositor reddish brown.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	12-14.5	3	15-19.5	12.5	7.5-9
Male	12-13.5	3	13-18	12	

This grasshopper is very common throughout Connecticut in moist meadows from early July until late in the fall.

X. brevipenne Scudder. Short-winged Meadow Grasshopper.

Body rather shorter and stouter than in *fasciatum*. Posterior femora somewhat stout and rather short. The color is a light reddish brown, the face and sides of pronotum generally green. A broad, dark brown, longitudinal stripe bordered on either side with a line of yellow on occiput and disk of pronotum. The ovipositor wholly reddish brown, darker towards tip. Long-winged specimens occur rarely.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	11-13	3.5	7-8	11-12.5	10-12
Male	11	3	7-8	10-11	

This is also a very common species throughout the state, in damp fields, and plentiful on the salt marshes.

X. ensiferum Scudder.

"Very similar in general appearance to *X. brevipenne* Scudder, and may be only a large variety of that species. Typical examples are larger, with a longer ovipositor, which is equal

in length to the body and equals or slightly exceeds the length of the hind femora. Tegmina of the common short-winged form covering about two-thirds of the abdomen in the female; usually reaching its tip in the male. Hind femora usually unarmed, though sometimes bearing one to four small teeth on their lower outer carina. Cerci of male rather stout, with the apical half curved slightly outward and depressed. Ovipositor slender, straight. The general color is more of a green than in *brevipenne;* the face, sides of pronotum and abdomen, and usually the four anterior femora being of that hue. The tegmina and wings are light reddish brown, as are also the tibiæ and ovipositor."*

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	12-14	3.5	8.5	13.5	12-14
Male	12.5	3.5	10	13	
Long-winged female			14.		

North Madison, last week in August (W. S. B.).

Orchelimum Serville.

Closely resembling *Xiphidium,* but of larger size. Spines of the prosternum cylindrical and slender. Wing covers narrow, often tapering towards the apex, surpassing the tip of the abdomen in our species. Wings extending beyond the tips of the tegmina. Calling organ similar but larger in proportion than in *Xiphidium.* Ovipositor stout, broad, and usually upcurved beyond the middle.

Key to Species.

1. Face without a brown median stripe..... 2
   Face with a dark reddish brown stripe down the center **herbaceum**
2. Tegmina and wings of nearly equal length, extending but little beyond the tips of the hind femora; size medium (body 18-19 mm.).....**vulgare**
   Tegmina shorter than the wings, distinctly surpassing the tips of the hind femora; size larger (body 22-23 mm.) ..... **glaberrimum**

*Blatchley. "Orthoptera of Indiana," p. 375.

O. vulgare Harris. *O. agile* De Geer, of Scudder's catalogue. Common Meadow Grasshopper. Plate XI, 1.

General color grass-green or light reddish brown. Face pale green or light brown without fuscous stripe. A brown dorsal stripe which is narrow on the occiput and broadened on the disk of the pronotum. The male with two black dashes on either wing cover, which form the corners of a square area which encloses the calling organ. Legs light brown with the tarsi darker. The antennæ slender, about twice as long as the body. Pronotum long, with posterior margin well rounded. The tegmina are usually about as long as the wings and reach to or slightly surpass the tips of the hind femora.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	19	5.5	20	15-20	8-9
Male	18	5.5	20	13.5-17	

Very common throughout the state from the middle of July until fall. Frequents moist places where the grass and weeds are thick and succulent.

O. herbaceum Serville. *O. concinnum* Scudder.

Much more slender than *vulgare,* with narrow wing covers. General color grass-green. A broad, reddish brown longitudinal stripe on the pronotum and on the occiput, where it is narrowed to the width of the apex. This stripe is continuous down the face, extending broadly toward the clypeus. Legs green, with more or less brown. Wing covers extending beyond the tips of the hind femora, somewhat shorter than the wings in both sexes. Ovipositor slightly curved.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	18	4-4.5	20	13-16	8
Male	18	4-4.5	20	15	

Occurs on salt marshes from July until late fall.

O. glaberrimum Burmeister.

Similar to *vulgare* but larger, considered by some as a form of that species. In the female the brown stripe on the pronotum

is more distinctly margined with black, and in the male the black dashes on the tegmina are larger. The tegmina of the male surpass the hind femora by about 4 mm., and the wings are about 4 mm. longer than the tegmina.

The measurements given by Blatchley are as follows: —

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	23	6.5	24-27	20	8.5
Male	22	6	26	19	

This insect should be looked for in locations similar to those frequented by the preceding species. We have no record of this species, but Scudder in his New England catalogue gives "Connecticut" as a locality in which it has been found.

DECTICINÆ.

The members of this sub-family are wingless or with very rudimentary wings. The hearing organs are small and narrow, situated near the base of the fore tibiæ, the latter having an apical spine on their outer upper side.

"The tarsi are all more or less depressed, and their first two joints are sulcate lengthwise on the sides; while the first joint of those of the hind legs bears a free plantula (pad) beneath its base." — *Blatchley.*

This sub-family is well represented in the West, but in Connecticut we have but one genus with two species.

Atlanticus Scudder.

Head with rounded face and small, nearly round eyes. Face broad; vertex extending between the antennæ in the form of a blunt, decurved ridge. Pronotum flattened on top, narrowed in front, and extending back over first abdominal segment; posterior margin well rounded, lateral lobes bent abruptly downward, lateral carinæ sharp. Tegmina of females rudimentary, wholly covered by the pronotum; those of the male about half as long as the body. Stridulating organ of male covered by pronotum. Wings very rudimentary or wanting. Posterior femora long and rather slender, passing the end of the abdomen in both sexes. Ovipositor stout at base, straight, about as long as the body.

The members of this genus are called "shield-back grasshoppers" on account of the large pronotum.

Key to Species

Pronotum more than half the length of the posterior femora, the front margin narrow, but little more than half as wide as hind margin.....**pachymerus**

Pronotum not more than half the length of the posterior femora, the front margin about three-fourths the width of the hind margin.....**dorsalis**

A. pachymerus Burmeister. Plate XI, 2.

Grayish or reddish brown; the upper portion of lateral lobes of pronotum of the male black, often shining. Wing covers marked with black. A curved, yellow line above the posterior angle of the pronotum, which in the female is bordered above with black. Abdomen and femora sprinkled with minute black dots. The lateral carinæ of pronotum sharp and the posterior margin broadly rounded. The hind femora and ovipositor somewhat shorter than in *dorsalis*.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	20	9		15	20
Male	19	9	8	15	

This insect is rare in Connecticcut. Occurs in dry localities. Scotland, 27 July, 2 September (B. H. W.).

A. dorsalis Burmeister.

The male is usually dark brown sprinkled with gray, female somewhat lighter. The pronotum is slightly longer than in *pachymerus,* the posterior margin more nearly truncate, and the lateral carinæ less sharp.

Measurements.

	Body	Pronotum	Hind Femora	Ovipositor
Female	24	9.5	20.5	23-30
Male	19	9	19	

This insect occurs in locations similar to those of the preceding species. We have no record of the occurrence of this insect in the state, but Scudder, in his list of the Orthoptera of New England, states that *dorsalis* has been reported from every New England state but Maine.

STENOPELMATINÆ.

The insects belonging to this sub-family are commonly called "stone-" or "camel-crickets." One genus is represented in Connecticut.

Ceuthophilus Scudder.

Wingless *Locustidæ,* medium or large in size, with a thick body. Head large, oval, deflexed, extending backward between the fore legs. Vertex without tubercles. Eyes somewhat pyriform in shape, widest at the top, and situated close to the base of the antennæ, which are long, slender, and cylindrical. Maxillary palpi long and slender, the first joint longest, grooved beneath at the apex. Pronotum short, prosternum unarmed. Hind femora stout, turned inward at the base, channeled beneath, with the margins of the channel either serrate or spined in the male, nearly smooth in the female. Ovipositor well developed, slightly upturned at the tip. Cerci of male long and slender, usually thickly clothed with hair. The members of this genus are nocturnal in habit, and are usually found in damp places under stones, bark of stumps, logs, and in damp, dark cellars. Uusually but one or two pairs are found together. Our collection contains very little material in this genus, and the following keys and descriptions are mainly taken from other papers. The females are very hard to identify, and the keys are for distinguishing the males. The female is similar in color to the male, and as the species are usually found in pairs, these should be placed together in the collection.

Key to Species.

1. Large species; hind femora more than 20 mm. in length 2
   Smaller species; hind femora rarely more than 16 mm. in length 3
2. Hind femora less than four times as long as broad; hind tibiæ more than one-tenth as long as femora, more or less sinuate at base in old males.....**gracilipes**
   Hind femora more than four times as long as broad; hind tibiæ scarcely more than one-tenth longer than femora, straight at base.....**grandis**
3. Fore femora but little, if any, longer than the pronotum 4

Fore femora one-third or more longer than the pronotum 5

4. General color clear reddish brown mottled with paler brown; hind femora of male more than twice as long as the fore femora; each of the lower carinæ with about 25 crowded minute teeth.....**terrestris**

General color dull sooty brown, with numerous paler spots; hind femora of male about twice as long as the fore femora, with 7 to 15 small but distinct teeth on each of the carinæ.....**brevipes**

5. Hind tibiæ of male arcuate or sinuate in basal half; fore femora rarely exceeding the length of the pronotum.. **maculatus**

Hind tibiæ straight; fore femora somewhat longer than the pronotum 6

6. Hind femora stout, with 8 to 10 rather large unequal spines on the lower outer carinae.....**latens**

Hind femora rather slender, with 12 to 20 spines on the lower outer carinae well separated from each other .....**pallidipes**

Hind femora rather stout, with 25 to 30 minute spines on the lower outer carinae more or less crowded together .....**neglectus**

C. gracilipes Haldeman. Plate XI, 3.

Light yellowish to dark, heavily marked with irregular black blotches, the dark colors prevailing on the posterior half of all the segments. Outer sides of the hind femora with the black transverse bars more or less distinct. Antennæ long, three to four times the length of the body. Legs very long and slender. Fore femora more than half as long as the pronotum, the inner carina with two to three spines. Hind femora as long as, or longer than, the body, considerably more than twice the length of the fore femora, very stout at the base. Outer carina in male with about thirteen distinct, unequal, rather coarse spines. Hind tibiæ straight, or in old males slightly waved in the basal third; about a sixth longer than the hind femora. Cerci nearly a third as long as the hind femora. Ovipositor with the basal third stout, rather slender towards the tip; nearly three-fourths the length of the hind femora.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	23	6.75	10.6	22	25	15.5
Male	19	5.75	10	21.5	24.75	

Occurs during July and August, in dark damp cellars, under the bark of fallen trees, and in similar places. New Canaan, 15 September (B. H. W.).

C. grandis Scudder.

Color and markings similar to *gracilipes*. Legs very long and slender. Antennæ fully four times as long as the body. Fore femora about one and two-thirds the length of the pronotum, inner carina with three to four rather short, sub-equal spines. Hind femora as long as the body, very little more than twice the length of the fore femora, rather stout at base; the outer carina with eight to twelve distinct, nearly equal spines. Hind tibiæ straight in both sexes, fully one-tenth longer than the femora. Cerci slender and delicately tapering. Ovipositor more than half as long as the hind tibiæ, slender apically.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	23.5	6.7	10.75	23.4	25.6	13.5
Male	19	6.7	11.25	22.8	25	

Occurs in places similar to those frequented by *gracilipes*. Mt. Carmel, 6 August (E. F. Coe).

C. terrestris Scudder.

Reddish brown, the abdomen mottled with pale spots; often a median light stripe above on the pronotum, bordered by darker blotches; legs lighter; hind femora with the dark transverse bars not very prominent. Fore femora somewhat longer than the pronotum, unarmed. Hind femora rather stout, both carinæ of male with about twenty-five small tooth-like serrations; those of the female unarmed or with minute teeth on the apical third. Hind tibiæ straight, a little shorter than the hind femora. Ovipositor less than three-fifths the length of the hind femora, a little pointed and upturned at the tip.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	16	5	6.5	15	15	8
Male	13	5	6	16	15	

A female in our collection, labeled, "probably *terrestris*," bears the data: — Salisbury, *27* August (W. E. B.).

C. brevipes Scudder.

Dull sooty brown, very freely mottled with dull yellow spots; thorax darker, usually with a narrow median stripe of clay-yellow. Body robust, fore femora one-third or more longer than the pronotum; a single spine on the lower outer carina. Hind femora short and stout, both carinæ in the male with seven to fifteen small, saw-like teeth on apical half; teeth smaller in female. Hind tibiæ straight, distinctly longer than hind femora. Ovipositor rather slender, about two-thirds the length of hind femora, the tip but little upturned.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	16	4.5	6.5	15	16	8
Male	13	5	6	14	15	

A record furnsihed by Professor Blatchley is as follows: — "North Madison, August (last week). Two taken from beneath stones."

C. maculatus Say. Spotted Camel Cricket.

Dark sooty brown above; thoracic segments often with a lighter brown median stripe; below, yellowish brown. The abdominal segments with small yellow spots above, arranged more or less in regular transverse rows. Legs reddish brown, hind femora with narrow dark brown cross-bars arranged in narrow rows. Fore femora slightly longer than the pronotum, the inner carina with one or two rather long sub-apical spines. Hind femora of male with the outer carina with twelve to fifteen unequal spines, the inner carina with a similar number of nearly equal minute spines. Hind tibiæ of male a little longer than hind femora, with the basal third bowed. Ovipositor about two-thirds the length of the hind femora, slightly tapering to the tip, which is upturned.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	16	5	6	16	17.25	10
Male	14	5	6	15	17	

This is our most common species, found in damp cellars, under stones, logs, etc. From various parts of the state, from June until December.

C. latens Scudder. Black-sided Camel Cricket.

Thorax with a median reddish brown stripe, on either side of which is a broad blackish stripe extending about half way down the sides, and back onto one or more segments of the abdomen. The sides below the dark bands are pale yellow. The abdomen and outer faces of hind femora spotted with brownish yellow. Legs light brown. Fore femora nearly a third longer than the pronotum. Hind femora stout with eight or nine spines on the outer carina, the four or five middle spines rather strong and prominent. Hind tibiæ straight, seldom longer than the hind femora. Ovipositor nearly twice as long as the fore femora, straight, with the tip a little upturned and acute.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	24	6.5	7	19	20	11
Male	22	6.5	7	19	21	

Under stones, Lyme, 21 August (B. H. W.).

C. pallidipes Walker.

Color and markings very similar to *latens*. This species is much smaller, however, the hind femora more slender, and differing greatly in the character of the spines. The ovipositor is stouter at the base than in *latens*.

Measurements.

	Body	Pronotum	Fore Femora	Hind Femora	Hind Tibiæ	Ovipositor
Female	14	4.3	5.8	14	14.8	9
Male	14	4.1	5.8	13.5	14.8	

One male, probably this species, taken at New Haven, 17 June (B. H. W.)

C. neglectus Scudder.

Chestnut brown more or less mixed with smoky; females usually darker. A broad, more or less indistinct and broken yellowish median stripe on pronotum. Sides of pronotum and abdomen more or less spotted with yellowish. Legs usually yellowish to chestnut brown, tips of all femora dark. Hind femora with scalariform fuscous markings. Antennæ slender, two to three times as long as the body. Legs rather slender and moderately short. Fore femora very little longer than the pronotum. Hind femora stout, about as long as the body and about two and one-fourth times as long as the fore femora. Outer carina minutely, closely, and uniformly serrate. Hind tibiæ slender, straight in both sexes, about as long as, or no longer than, the hind femora. Cerci moderately stout. Ovipositor half as long as hind tibiæ, straight, tapering in the basal half, the tip slightly upcurved and acutely pointed.

Measurements.

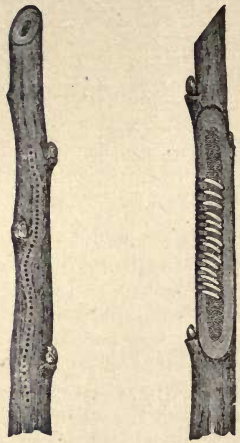
	Body	Pronotum	Fore femora	Hind femora	Ovipositor
Female	12.5	4.6	5	11.7	6
Male	12.5	4.4	5	12	

Lyme, 1 May (A. B. C.); Lyme, 21 August (B. H. W.).

GRYLLIDÆ.

This family includes the crickets. The wing covers are flat on the dorsal part of the abdomen and bent abruptly down at the sides. The tarsi are three-jointed, without pads (pulvilli) between the claws; the fore coxæ longer than broad. The ocelli are usually present, and the antennæ, as in the *Locustidæ*, are long and slender. The hearing organ when present is also situated on the base of the fore tibiæ. The calling organ, as in the preceding family, is near the base of the tegmina of the males, but is larger, extending across both the anal and median areas of the tegmina. The chirp of the crickets, with which we are all familiar, is made only by the males, and is produced by rubbing the veins of the area of one tegmen over those of the other. The hind wings of the crickets are usually short and of but little use as organs of flight, though sometimes they extend nearly twice the length of the tegmina. The hind femora are

well developed, and the insects of this family are ready leapers. The ovipositor of the female, when protruding, is usually long and cylindrical, with the tip often enlarged. The eggs of most species are deposited singly in the ground, while those that burrow in the ground deposit theirs in irregular masses in their burrows. The tree-crickets lay their eggs in single rows in the pith of the stems of various plants. See Fig. 60.



a *b*

FIG. 60. Eggs of tree cricket in peach twig. *a*. Twig showing punctures. *b*. Twig cut to show the eggs.

Key to Sub-families.

1. Tarsi with the second joint minute, flattened laterally 2
   Tarsi with the second joint distinct, flattened vertically, heart-shaped .....TRIGONIDIINÆ p. 161
2. Fore tibiæ not enlarged; female with the ovipositor extended 3
   Fore tibiæ enlarged, fitted for digging; female without an extended ovipositor .....GRYLLOTALPINÆ p. 149
3. Hind tibiæ rather stout, armed with two rows of stout spines, without teeth between them....GRYLLINÆ p. 150
   Hind tibiæ slender, unarmed, or the spines slender with minute teeth between .....ŒCANTHINÆ p. 155

GRYLLOTALPINÆ.

The crickets of this sub-family have the fore legs modified so that they are fitted for digging, and burrow in the ground. The antennæ are much shorter and stouter than in our other *Gryllidæ*. The ovipositor of the female is not extended so as to be visible.

Key to Genera.

Body more than 25 mm. in length. Fore tibiæ broadly expanded and with prominent claws; hind femora slender; tarsi three-jointed .....**Gryllotalpa** p. 149

Body less than 10 mm. in length. Fore tibiæ not broadly expanded, but with three or four spines at the apex, hind femora stout; tarsi with but one joint...**Tridactylus** p. 150

Gryllotalpa Linnæus.

Head small; eyes about one-fourth as large as in other large-sized *Gryllidæ*. Pronotum large, the front emarginate, the posterior margin well rounded, the dorsal surface and sides convex, with the lateral carinæ absent. Abdomen rounded, about twice as long as pronotum. Fore legs modified for digging, very stout, broad, flattened, and furnished at apex with four claws. The upper two, which are the largest, are movable, while the others are fixed. Posterior femora but slightly enlarged, and shorter than the pronotum. Hind tarsi short. The ovipositor of the female is not visible, and the sexes are distinguished by the difference in the venation of the upper wing covers, due to the presence of the calling organ in the male. Cerci long and slender.

G. borealis Burmeister. *G. columbia* Scudder. Northern Mole-cricket. Plate XI, 4.

General color seal-brown, thickly covered with short, fine hairs, giving the insect a velvety appearance. The tegmina from about one-half to three-fourths the length of the abdomen. Wings dimorphic, slightly exceeding the tegmina in the short-winged form, or exceeding the tip of the abdomen in the long-winged form.

Measurements.

Body	Pronotum	Tegmina	Hind Femora
26-30	7-9.5	9-12	7.5

This insect will be readily recognized by its resemblance in miniature to a mole. It is found in the mud or sand along the margins of streams and ponds. Here it makes small burrows resembling those of a mole, about the size of a lead pencil. Not common. New Haven (shore of Lake Whitney), 4 August, Bloomfield, 18 October (W. E. B.).

Tridactylus Oliver.

Head and pronotum rounded; eyes oval; antennæ short. The fore tibiæ not broadly expanded as in *Gryllotalpa,* but furnished with four apical spines or teeth. These teeth vary much in size and form. The tegmina are horny and opaque, not reaching the tip of the abdomen, and the males are not furnished with a calling organ. The hind wings are long and folded lengthwise like a fan. The posterior femora are long and broad, and, unlike the large mole-crickets, the members of this genus are active leapers. The species of this genus are " sand crickets," and are among the smallest crickets. The largest of the three species found in the United States is less than 10 mm. (about ⅜ of an inch) in length.

T. terminalis Uhler. Plate XI, 5.

General color glossy black, more or less marked with reddish brown spots. Posterior femora with two white spots or fasciæ. The wings reach to the tip of the abdomen or somewhat surpass it in both sexes.

Measurements.

Body	Pronotum	Tegmina	Hind Femora
6-8	2	3	3.5

This insect makes very small burrows in the sandy margins of ponds. We have not taken the sand cricket in this state, but Scudder states that it has been taken in Connecticut.

GRYLLINÆ.

This sub-family includes the ground and field crickets which are everywhere so common during the summer and fall.

Key to Genera.

Last joint of maxillary palpi twice the length of the one preceding; hind tibiæ with long, movable, pilose spines;

first joint of hind tarsi unarmed above or with one row of small teeth.....**Nemobius** p. 151

Last joint of maxillary palpi but little, if any, longer than the one preceding; hind tibiæ sulcate above, with a row of teeth on each side.....**Gryllus** p. 153

Nemobius Serville.

Crickets of small size. Head and thorax of nearly equal width, clothed with rather long hairs. First, second, and fourth joints of maxillary palpus small, the third and fifth larger, the fifth or last joint about twice the length of the fourth and enlarged at the apex. Wing covers with the veins running lengthwise, while in the females of *Gryllus* the veins run obliquely from each side. Hind tibiæ with long unequal spines.

Key to Species.

1. Ovipositor shorter than hind femora, usually more or less curved 2
   Ovipositor longer than hind femora, nearly straight.. **fasciatus**
2. Tegmina of male reaching tip of abdomen, yellowish brown in color. Length of body of female more than 8 mm. .....**carolinus**
   Tegmina reaching only two-thirds to three-fourths the length of the abdomen, black or very dark brown in color. Length of body of female less than 6.5 mm. **palustris**

N. fasciatus DeGeer. The Striped Ground Cricket. Plate XI, 6 and 7.

The type form of this species is long-winged; the short-winged form, *vittatus,* is, however, much more common. The general color of the short-winged form is a dusky brown to a rusty black, the tegmina and legs sometimes paler. The head is marked with four black longitudinal stripes which are hardly discernible in the darker specimens. The long-winged form is usually nearly black, the head and pronotum clothed with long hairs. The tegmina of the male are as long, or nearly as long, as the abdomen, while those of the female cover about half the abdomen.

In the long-winged form the wings are more than twice the length of the tegmina.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	9.5-11	3	4	6.5	8-9
Male	10	3	5	6.5	

The wings in the long-winged form, 13 mm.

The short-winged form is very common throughout the state from early July until after frost. The long-winged form is quite rare.

N. carolinus Scudder. *N. affinis* Beutenmüller.

Head, antennæ, and pronotum varying from dull yellow to dusky brown; the latter more or less mottled with dark. Head and pronotum sparsely clothed with long, black, bristly hairs. Tegmina brownish yellow with a black bar on the upper third of the lateral field. The legs dull brownish yellow, often mottled with black. Tegmina of males as long as abdomen, those of the female covering about half of the abdomen. Wings absent. Cerci very slender and as long as the abdomen. Ovipositor moderately stout, shorter than the hind femora and slightly upcurved.

Measurements.

	Body	Tegmina	Hind Femora	Ovipositor
Female	8.5	3.5	6.2	3.8
Male	7	4.2	5.3	

Apparently not very common in Connecticut. Should be looked for on sunny slopes and in open woods. West Woodstock, September (W. B.); Lyme, 21 August (B. H. W.).

N. palustris Blatchley. Marsh Ground Cricket.

"Size, small; the body of male especially short and broad. Head tumid; eyes large, but not prominent. Pronotum one-third broader than long, the sides sub-equal, rather thickly beset with stiff, black bristles, as are also the forehead and dorsal surface of the two front femora. Head, tegmina, and body of most specimens a uniform dark piceous; disk of pronotum piceous, or fuscous sprinkled with piceous. Antennæ, legs, and ovipositor fuscous. Maxillary palpi yellowish, except the apical joint which

is wholly piceous. Tegmina of female covering a little more than half the abdomen; those of the male hardly reaching its tip. Ovipositor about a third shorter than hind femora, distinctly though feebly arcuate, the apical blades but little enlarged at the base, very finely serrulate with dull, rasp-like teeth." — Blatchley.

Measurements.

	Body	Tegmina	Hind Femora	Ovipositor
Female	6.2	3	5	3.5
Male	5.8	4	4.5	

This small species inhabits swampy places, often living in sphagnum moss. Canaan, South Kent, August 18-19 (A. P. M.); Salisbury, 27 August (W. E. B.); Lyme, 21 August, New Haven, August and September (B. H. W.).

Gryllus Linnæus.

This genus includes the large dark colored field crickets. The body stout, head large and globose; eyes large and rounded. Antennæ slender, longer than the body. Pronotum wider than long, the width about equalling that of the head. Hind femora stout; hind tibiæ with two rows of long fixed spines, their length increasing towards the apex. Ovipositor as long as or longer than the hind femora, the length varying but little in the same species. Some species are dimorphic as regards wing length.

Key to Species.

1. General color black, tegmina often dull reddish brown; basal joint of antennæ not projecting beyond front of head 2
   Straw-colored, head and thorax marked with brown; basal joint of antennæ projecting slightly beyond front of head: ..... **domesticus**
2. Ovipositor more than 18 mm. in length; about one and one-half times the length of the hind femora. Male stout, head large and broad ..... **abbreviatus**
   Ovipositor not more than 14 mm. in length; about one and one-fourth times the length of the hind femora. Male more slender, head more narrow... **pennsylvanicus**

G. abbreviatus Serville. Common Field Cricket. Plate XI, 8. Body large and wide. Head shining black, that of the male much swollen and broader than the pronotum, less prominent in the female. Pronotum about one and one-half times as wide as long. Tegmina usually dark reddish brown to black, sometimes dull yellowish brown, covering the abdomen in the male or about three-fourths of the abdomen in the female. Wings much shorter than the tegmina in the type, or twice their length in the long-winged form, *luctuosus*. Hind femora very stout, dark reddish brown to black. Ovipositor very long, equaling or exceeding the body in length, and nearly or fully one and one-half times the length of the hind femora.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	18-22	4.75	12	13	18-20
Male	18-21	4	12	13	

Common throughout the state from August until frost.

G. pennsylvanicus Burmeister.

A rather broad species with the head of the male less swollen than in *abbreviatus;* pronotum slightly wider in proportion than in the above species. The tegmina vary in color from deep black to grayish brown, often with a yellowish brown line along the humeral angle; the tegmina reach the tip of the abdomen in the male, nearly to the tip in the short-winged female, or slightly surpass it in the long-winged form. Hind femora short and stout. Ovipositor always shorter than the body, slightly longer than the hind femora.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	22	4	9	12	14
Male	16-17	3.5	10	12	

Common throughout the state from May until frost; is found under stones and rubbish.

G. domesticus Linnæus. House Cricket.

Pale yellowish brown or straw-color, with reddish brown markings on head and pronotum. Tegmina reaching nearly or

quite to the tip of the abdomen, sometimes a reddish brown spot on their basal third. Inner wings either abbreviated or extending considerably beyond the ends of tegmina. Hind femora short and slender. Ovipositor about one and one-fifth times the length of the hind femora, pale brown becoming darker towards the tip.

Measurements.

	Body	Tegmina	Pronotum	Hind Femora	Ovipositor
Female	15	11	3.5	10	12
Male	16.5	11	3.5	10	

This cricket is very numerous in Europe and is the "cricket on the hearth." It is very rare in this section, though it has been taken in the vicinity of New York. It is probably less common now than it was when the old-fashioned stone fireplaces were used. We have no records of the capture of this species in Connecticut.

ŒCANTHINÆ.

This sub-family contains the small whitish insects known as tree crickets. Two genera are represented in Connecticut.

Key to Genera.

Hind tibiæ armed with weak spines; first joint of antennæ without spine on under side; hind wings at most but little longer than the tegmina.....**Œcanthus** p. 155

Hind tibiæ not armed with spines; first joint of antennæ with a blunt tooth on the under side; hind wings nearly twice as long as the tegmina.....**Xabea** p. 161

Œcanthus Serville.

Head and thorax elongated; the latter with deflexed sides and the anterior portion of pronotum somewhat narrower than the posterior. Wing covers of the female regularly reticulate, with the oblique longitudinal veins plainly visible; wing covers bent around the body, while the male is given a much broader appearance by having the wing covers flattened; they are also more transparent and of a firmer texture than those of the female. Hind femora slender; tibiæ armed with weak spines between which are minute teeth; tarsi four-jointed, long and slender, with the second joint very small and compressed. Ovipositor shorter

than hind femora, straight, with the apex slightly enlarged and rather blunt.

This genus includes the small greenish white insects known as tree crickets. These may be seen throughout the latter part of the season clinging to tall weeds and shrubs, or on the trunks and large branches of trees. The eggs of the tree crickets are deposited in the tender shoots or pith of various plants. See Fig. 60. Raspberries and blackberries are often seriously injured by at least one species, whose punctures so weaken the canes that they readily break off.

Key to Species.

1. Antennæ with one or more black marks on the under side of each of the first two basal joints. Tegmina of male narrow, the width less than half the length.... 2
   Antennæ without black marks on the under side of the first two basal joints. Tegmina of male broad, the width more than half the length.....**latipennis**
2. The two basal antennal joints each with one mark.... 3
   Antennæ either black or with two marks on each of the two basal joints..... 5
3. Antennal marks elongated, of unequal size..... 4
   Antennal marks consisting of small oval dots (Fig. 61) **niveus**
4. First antennal mark long and straight, second mark oblong (Fig. 63).....**exclamationis**
   First antennal mark long and hooked at base; second joint with oblong mark (Fig. 62).....**angustipennis**
5. Head and thorax greenish yellow or yellowish brown; antennal marks distinct..... 6
   Head and thorax black or striped with black; antennæ usually black, but, when marks are discernible, those of first joint generally connected at apex (Fig. 64) **fasciatus**
6. Pale greenish or yellow; antennal marks distinct, parallel; outer mark on first joint nearly round (Fig. 65) **quadripunctatus**
   Head, thorax, and legs testaceous; outer mark on first joint elongated and oblique (Fig. 66).....**pini**

Œ. latipennis Riley. Broad-winged Tree Cricket.

Male, greenish white; female yellowish green. Antennæ without black markings on the basal joints. These joints and top of head are of a distinct pink color. The wing covers of the male are much wider than in any of our other species. Blatchley gives the following: —

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	12.5	3.1	14.5	10	6.5
Male	12.5	3.1	15	10	

Width of dorsal surface tegmina of male, 7.5 mm.

This insect is said to live on low plants in damp places. Should be looked for during September and October. We have no record of this species being taken in the state.

Œ. niveus DeGeer. Snowy Tree Cricket.

FIG. 61. *Œcanthus niveus* Basal joints of antenna, showing markings.

General color greenish ivory-white. The under side of the two basal joints of the antennæ each with a small, roundish, black spot. Head larger and pronotum wider anteriorly than in *angustipennis*. The maxillary palpi are longer than in the other species. The tegmina are much longer than the abdomen, and the wings equal to, or slightly longer than, the tegmina. Ovipositor short, straight, and usually tipped with black.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	14	2.25	14	11	5.5
Male	12	2.25	12	10	

Much has been written in the past regarding this species and the injury caused by it. From careful observation it is thought that in much of this literature other species have been confounded with this one. From our experience *niveus* is much less common than at least three of our other species. New Haven, 16 August (P. L. B.); Norwalk, 13 October (W. E. B.); New Haven, 12 October, Windsor, 13 September (B. H. W.).

Œ. angustipennis Fitch. Narrow-winged Tree Cricket. Plate XI, 9 and 10.

FIG. 62. *Œcanthus angustipennis.* Basal joints of antenna, showing markings.

Pale yellowish green, top of head and thorax sometimes yellowish brown. The basal antennal joint with an elongated black mark curved inward at the base, second joint with an oblong black mark. Head small, anterior portion of pronotum narrow. Tegmina narrower than in any other species excepting *quadripunctatus.*

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	12	2.5	12	9	5
Male	12	2.5	11.5	9	

This species is quite common around New Haven. Often seen resting on the trunks of trees. New Haven, 14 August to 12 October, Hartford, 22 September, New Canaan, 19 September to 20 October (W. E. B.).

Œ. exclamationis Davis.

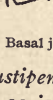


FIG. 63. *Œcanthus exclamationis.* Basal joints of antenna, showing markings.

Closely related to *Œ. angustipennis,* but is larger, and the top of pronotum is not clouded, as is often the case in the latter species. The general color is pale greenish white, and the black markings on the antennæ resemble an exclamation point. The long mark on the first joint is not bent at the base as in *Œ. angustipennis.*

This species was described by Mr. Davis in *Canadian Entomologist,* Vol. XXXIX, p. 173, 1907. Specimens sent to him by the writer were pronounced to be of that species. Collected

on trunks of trees in company with *Œ. angustipennis*. New Haven, 20 August to 12 October (B. H. W.).

Œ. fasciatus Fitch. *Œ. nigricornis* Walker. Striped Tree Cricket. Plate XI, 11.

FIG. 64. *Œcanthus fasciatus*. Basal joints of antenna, showing markings.

General color greenish yellow, the body and legs often darker. Head and pronotum with from one to three longitudinal diffused black lines, often entirely black. Antennæ about two and one-half times the length of the body. Entirely black or with two black marks on each of the two basal segments. The inner mark on the first joint twice as long as the other mark, with which it is often united at the apical end of the joint. Tegmina somewhat narrower than those of *niveus*. Apical spines of posterior tibiæ stronger and more acute than in allied species. Ovipositor slightly upcurved towards apex.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	12	3	12	9	6
Male	12.5	3	12	9.5	

Our most common species; found on tall weeds and bushes along the roadsides, fence-corners, and the edges of swamps. Much of the damage credited to *niveus* may be due to this species. The writer has observed *fasciatus* ovipositing in *Spiræa* sp. in a nursery. Occurs throughout the state.

Œ. quadripunctatus Beutenmüller. Four-spotted Tree Cricket.

FIG. 65. *Œcanthus quadripunctatus*. Basal joints of antenna, showing markings.

Pale yellowish green in color; antennæ light brown, two basal joints each with two black marks on under side; the inner mark on first joint about two-thirds the length of the joint, the upper end curving towards but not uniting with the outer mark, which is small and nearly round. The marks on second joint parallel, the inner mark about twice the length of the outer. Wing covers very narrow.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	11.5	2.5	10	8.5	5.2
Male	11.5	2.5	11	8	

This species is found in similar locations with *fasciatus*, and is our next most common species. Occurs throughout the state from August to October.

Œ. pini Beutenmüller.

FIG. 66. *Œcanthus pini.* Basal joints of antenna, showing markings.

"Head and antennæ testaceous, the latter becoming darker towards the tip; first two joints with four black marks; the inner mark on the first joint long and straight, the outer oblique; those on the second joint parallel; eyes black; thorax testaceous with a longitudinal line on each side above; anterior pair of legs testaceous; posterior femora green, tibiæ testaceous; body beneath black with the sides yellowish green; body above blackish with a green stripe along the back; elytra transparent, with grass-green veins; hind wing slightly protruding beyond the elytra; veins also green. The female is somewhat paler than the male, and the wings extend a little more beyond the elytra; ovipositor dark testaceous, tip black. Average length from head to tip of wing-covers, 14 mm.; body, 12 mm.; width, 4.5 mm. Somewhat resembles *Œ. nigricornis*,* but may readily be distinguished from it by the grass-green color of the wings and

* *Nigricornis* is now regarded as a synonym of *fasciatus* Fitch.

the testaceous head and thorax, and marks on basal joints of the antennæ. This insect lives only on pine trees, and usually on high branches."— Beutenmüller.

Œ. pini was described from specimens collected at West Woodstock, September, 1893, by W. Beutenmüller.

Xabea Walker.

This genus is closely related to *Œcanthus,* but may be distinguished as follows: — Antennæ without black markings, the basal joint with a blunt tooth on the under side. The veins of tegmina of female are more irregular than those in *Œcanthus.* The oblique longitudinal veins not conspicuous. Wings about twice as long as tegmina. Hind tibiæ with apical spines only. Tarsi 3-jointed, the second joint very short.

X. **bipunctata** DeGeer. Two-spotted Tree Cricket.

General color pinkish white to pinkish brown; a rather large blackish spot near the base of the tegmina in the female and another near the center; tegmina of male without spots. Wings very long, about 20 mm. Quite rare, and readily recognized by the color and the dark spots on the tegmina of the female.

Measurements.

	Body	Pronotum	Tegmina	Hind Femora	Ovipositor
Female	14	3	12	10	6
Male	14	3	12	10	

Portland, 14 August, New Canaan, 11 September (B. H. W.).

TRIGONIDIINÆ.

Crickets of very small size. The second tarsal joint is depressed and heart-shaped instead of compressed. The calling organ of the male is more simple than in the preceding crickets, being crossed by a single oblique vein. The ovipositor is short, compressed, and sabre-like.

Anaxipha Saussure.

The members of this genus look like small Nemobiids, but the females are distinguished by the compressed and strongly upcurved ovipositor, which somewhat resembles that of some of the *Locustidæ.* The antennæ are very long and bristle-like.

Wing covers of male nearly encasing the abdomen, with a round glassy spot on their apical half. Hind wings absent.

A. exigua Say.

Head and pronotum dark reddish brown, sparsely clothed with rather long hairs. Tegmina and legs lighter, the former reaching the tip of the abdomen in the male, shorter in the female. Abdomen of male nearly black, that of the female brown above, darker on the sides. Ovipositor dark brown, paler at tip. Cerci very long and slender with long yellow hairs.

Measurements.

	Body	Tegmina	Hind Femora	Ovipositor
Female	7	3.5	6	3.5
Male	6	4.5	6	

This pretty little cricket lives on bushes instead of on the ground, especially on or near the salt marshes. While not very common, it will probably be found by careful searching. Westbrook (in black grass), 30 August (H. L. V.).

NOTE — Under *Ischnoptera* should be included *I. borealis* Brunner. This roach resembles *I. uhleriana* and is considered identical by some writers. It is slightly smaller than the latter species, and in the male the supra-anal plate is broadly rounded, while that of *uhleriana* is more triangular. The supra-anal plate of the female is more obtusely angled but with the apex less rounded than that of *uhleriana*. Has been taken at Waterbury. Probably most of the records under *uhleriana* should be credited to this species.

Since this paper was in type, females of *Ischnoptera johnsoni* Rehn. (*intricata* Bl.) have been taken in the State. The female is much broader than that of *uhleriana* and darker in color (piceous). The wings reach only to the second abdominal segment, are narrow, and the inner edges separated by a distance equal to about one-half their breadth; while in *uhleriana* the inner edges of the wings of the female meet or slightly overlap.

Occurs in shady places under stones and rubbish.

New Haven, 14, 19 June (B. H. W.); Lyme, 3 July (A. B. Champlain); Southington, 12 July (W. E. B.)

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-C.F.Byers

PLATE I.

EGGS OF INSECTS. All natural size.

1. Eggs of Lace-wing or Golden-eye, *Chrysopa oculata* Say.
2. " " Luna moth, *Tropæa luna* Linn.
3. " " Squash bug, *Anasa tristis* DeGeer.
4. " " Peach saw-fly, *Pamphilius persicum* MacG.
5. " " Rose aphis, *Nectarophora rosæ* Linn.
6. " " Senator moth, *Anisota senatoria* S. & A.
7. " " Fall canker-worm, *Alsophila pometaria* Harris.
8. " " Giant water bug, *Belostoma* (or *Benacus*).
9. " " Variegated cut-worm moth, *Peridroma saucia* Hübn.

PUPÆ AND COCOONS OF INSECTS. Natural size except where otherwise stated.

10. Cocoon of Promethea moth, *Callosamia promethea* Drury.
11. Pupa of Southern tobacco worm, *Phlegethontius sextus* Johans.
12. Pupa of Northern tobacco worm, *Phlegethontius quinquemaculatus* Haw.
13. Cocoon of Mourning-cloak butterfly, *Euvanessa antiopa* Linn.
14. Cocoon of Chain-dotted geometer moth, *Cingilia catenaria* Drury.
15. Pupa of a Syrphid fly, *Baccha fascipennis* Wied. (Twice natural size.)
16. Pupa of a long-horned beetle, *Orthosoma brunneum* Forst.

Plate 1a

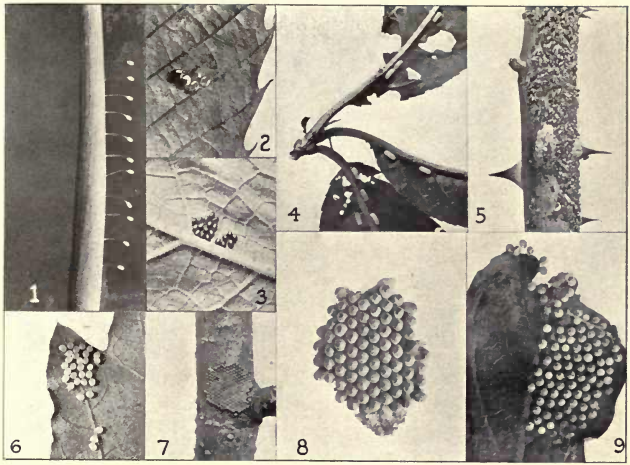


Plate 1b

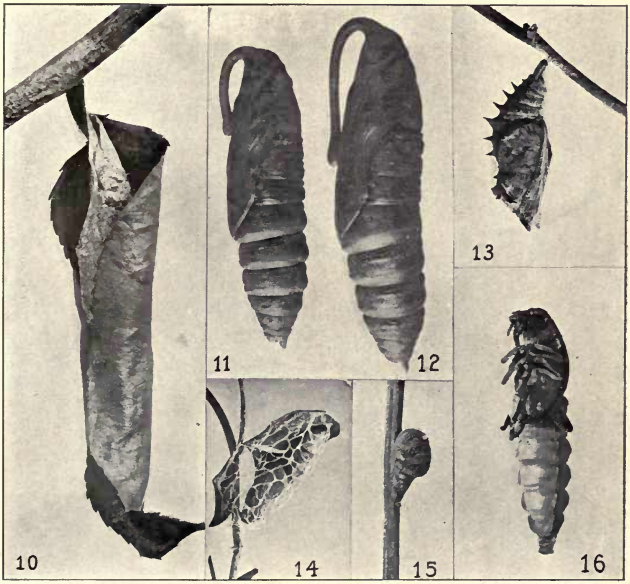


PLATE II.

LARVÆ (CATERPILLARS AND GRUBS) OF INSECTS. All natural size.

1. Larva of a Notodontid moth, *Apatalodes torrefacta* S. & A.
2. " " Abbott sphinx, *Sphecodina abbotii* Swains.
3. " " Elm-tree sphinx, *Ceratomia amyntor* Geyer.
4. " " a long-horned beetle, *Orthosoma brunneum* Forst.
5. " " a scarab beetle, *Ligyrus relictus* Say.

Plate II

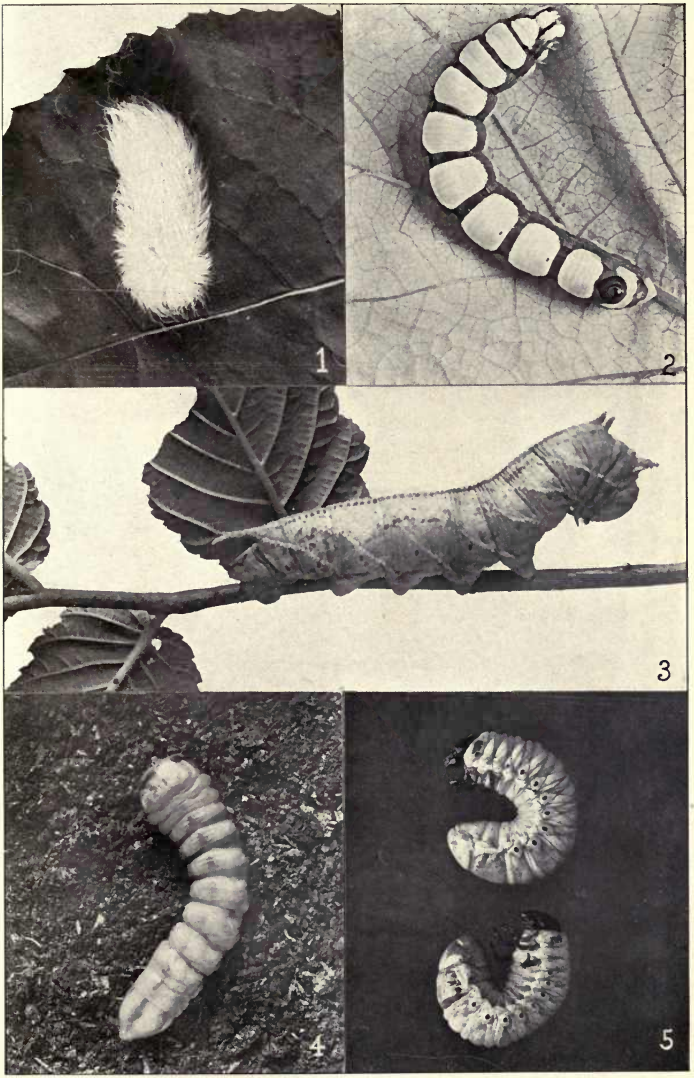


PLATE III.

ODONATA.

1. *Æschna constricta* Say.
2. *Libellula pulchella* Drury.
3. *Perithemis domitia* Drury.
4. *Calopteryx maculata* P. Beauv.
5. *Celithemis elisa* Hagen.

ORTHOPTERA.

6. *Diapheromera femorata* Say.
7. *Melanoplus femur-rubrum* De G.
8. *Melanoplus bivittatus* Say.
9. *Œcanthus nigricornis* Walk.
10. *Scudderia furcata* Brunn.
11. *Dissosteira carolina* Linn.
12. *Tettigidea parvipennis* Harris.
13. *Gryllus abbreviatus,* var. *luctuosus* Serv.
14. *Ischnoptera pennsylvanica* De G.

NEUROPTERA.

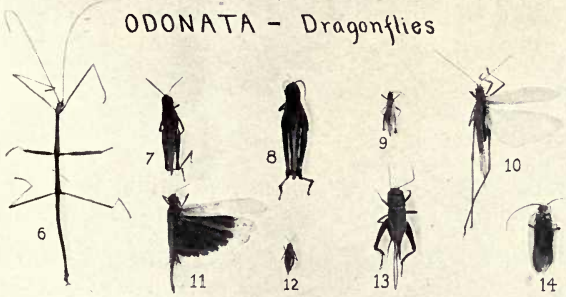
15. *Chauliodes pecticornis* Linn.
16. *Corydalis cornutus* Latr.
17. *Chrysopa oculata* Say.
18. *Myrmeleon immaculatus* De G.

HEMIPTERA.

19. *Benacus griseus* Say.
20. *Gerris remigis* Say.
21. *Anasa tristis* De G.
22. *Eulecanium corni* Bouché.
23. *Brochymena quadripustulata* Fabr.
24. *Euschistus variolarius* P. Beauv.
25. *Ceresa bubalus* Fabr.
26. *Gypona flavilineata* Fitch.
27. *Calocoris rapidus* Say.
28. *Cicada canicularis* Harris.

Plate III

ODONATA - Dragonflies



ORTHOPTERA-Cockroaches, Grasshoppers, Crickets

NEUROPTERA-Dobsons, Lace-wings, Ant-lions

HEMIPTERA-Bugs, Leaf-hoppers, Aphids, Scale-insects

PLATE IV.

LEPIDOPTERA.

BUTTERFLIES.

1. *Atrytone hobomok* Harr.
2. *Cercyonis alope* Fabr.
3. *Anosia plexippus* Linn.
4. *Argynnis cybele* Fabr.
5. *Chrysophanus thoe* Boisd.
6. *Strymon (Thecla) titus* Fabr.
7. *Polygonia interrogationis* Fabr.
8. *Papilio glaucus turnus* Linn.
9. *Vanessa huntera* Fabr.

MOTHS.

10. *Melalopha inclusa* Hübn.
11. *Phlegethontius sextus* Johans.
12. *Malacosoma americana* Fabr.
13. *Ennomos magnarius* Guen.
14. *Mesoleuca lacustrata* Guen.
15. *Paragrotis messoria* Harris.
16. *Sabulodes transversata* Drury.
17. *Hadena arctica* Boisd.
18. *Hemaris gracilis* G. & R.
19. *Noctua c-nigrum* Linn.
20. *Halisidota caryæ* Harris.
21. *Apantesis nais* Drury.
22. *Catocala unijuga* Walk.
23. *Samia cecropia* Linn.
24. *Automeris io* Fabr.

Plate IV

Butterflies

Moths

LEPIDOPTERA

PLATE V.

DIPTERA.

1. *Dasyllis grossa* Fabr. (*tergissa* Say).
2. *Proctacanthus philadelphicus* Macq.
3. *Tipula abdominalis* Say.
4. *Chrysopila thoracica* Fabr.
5. *Tabanus atratus* Fabr.
6. *Exoprosopa fasciata* Macq.
7. *Musca domestica* Linn.
8. *Psorophora ciliata* Fabr.
9. *Pollenia rudis* Fabr.
10. *Tabanus lineola* Fabr.
11. *Eristalis tenax* Linn.
12. *Syrphus torvus* O. S.
13. *Spilomyia fusca* Loew.
14. *Calliphora erythrocephala* Meig.
15. *Echinomyia algens* Wied.

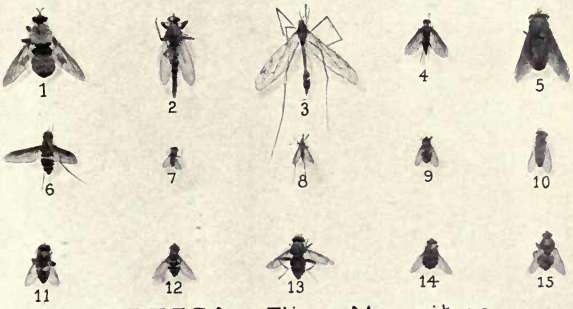
COLEOPTERA.

16. *Dytiscus verticalis* Say.
17. *Lachnosterna fraterna* Harris.
18. *Calosoma scrutator* Fabr.
19. *Copris anaglypticus* Say.
20. *Alaus oculatus* Linn.
21. *Staphylinus maculosus* Grav.
22. *Orthosoma brunneum* Forst.
23. *Leptinotarsa decem-lineata* Say.
24. *Necrophorus americanus* Oliv.
25. *Euphoria inda* Linn.
26. *Osmoderma scabra* P. Beauv.
27. *Crioceris duodecim-punctata* Linn.
28. *Parandra brunnnea* Fabr.
29. *Saperda candida* Fabr.
30. *Cicindela formosa*, var. *generosa* Dej.
31. *Blepharida rhois* Forst.
32. *Chalcophora virginiensis* Dru.

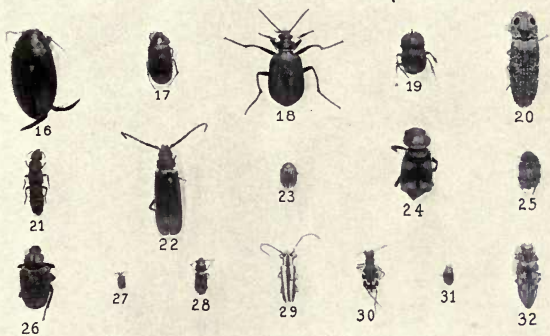
HYMENOPTERA.

33. *Cimbex americana* Leach.
34. *Sphecius speciosus* Dru.
35. *Tremex columba* Linn.
36. *Camponotus pennsylvanicus* De G.
37. *Pelecinus polyturator* De G.
38. *Sphex ichneumonia* Linn.
39. *Apis mellifera* Linn.
40. *Psilomastix exesorius* Brullé.
41. *Polistes pallipes* Lepeletier.
42. *Vespa diabolica* Saus.
43. *Bombus pennsylvanicus* De G.

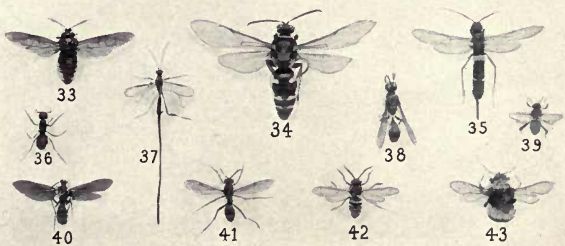
Plate V



DIPTERA- Flies, Mosquitoes



COLEOPTERA- Beetles



HYMENOPTERA- Bees, Wasps, Ants

PLATE VI.

1. *Tenodera sinensis* Saussure, Male.
2. Egg-mass of *T. sinensis* Saussure.
3. *Mantis religiosa* Linnæus (after Slingerland).
4. *Cyrtophyllus perspicillatus* Linnæus, Male.

Plate VI

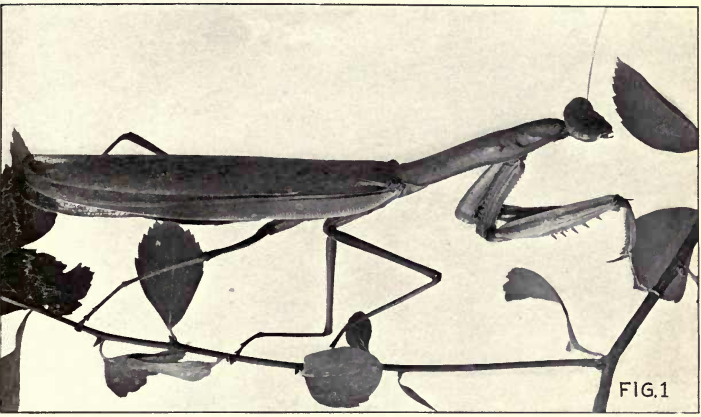


FIG. 1

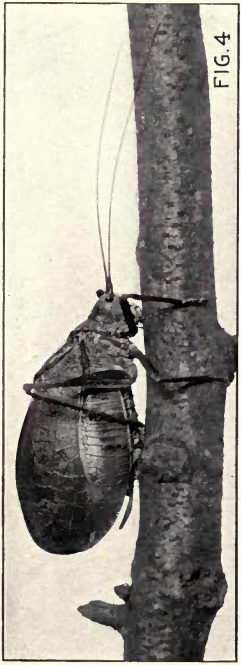


FIG. 4

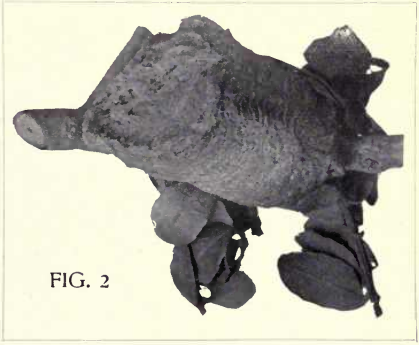


FIG. 2

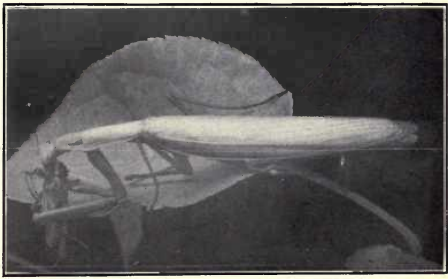


FIG. 3

PLATE VII.

1. *Anisolabis maritima* Bonnell.
2. *Ischnoptera pennsylvanica* De Geer, Male.
3. *Blattella germanica* Linnæus, Male.
4. *Blatta orientalis* Linnæus, Male.
5. *Periplaneta americana* Linnæus, Male.
6. Oötheca or egg case of a cockroach.
7. *Diapheromera femorata* Say, Female.
8. *Nomotettix cristatus* Scudder, Female.
9. *Tettix ornatus* Say, Female.
10. *Tettigidea parvipennis* Harris, Female.
11. *Pseudopomala brachyptera* Scudder, Female.
12. *Tryxalis brevicornis* Linnæus, Female.

Plate VII

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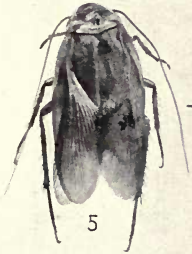
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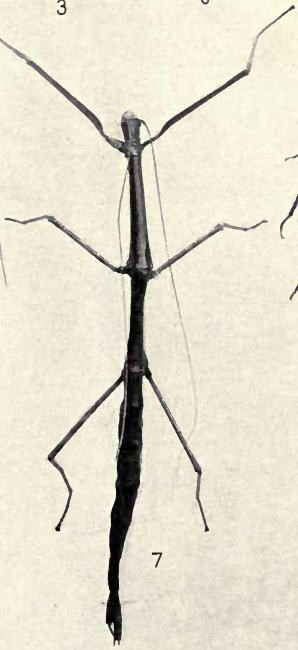
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PLATE VIII.

1. *Dichromorpha viridis* Scudder, Female.
2. *Orphulella speciosa* Scudder, Female.
3. *Chloealtis conspersa* Harris, Male.
4. *Stenobothrus curtipennis* Harris, Male.
5. *Arphia xanthoptera* Germar, Male.
6. *Chortophaga viridifasciata* De Geer, Female.
7. *Camnula pellucida* Scudder, Female.
8. *Hippiscus tuberculatus* Palisot de Beauvois, Female.
9. *Hippiscus tuberculatus* Palisot de Beauvois, Male.
10. *Scirtetica marmorata* Harris, Female.
11. *Circotettix verruculatus* Kirby, Male.

Plate VIII

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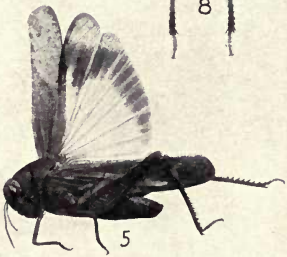
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PLATE IX.

1. *Dissosteira carolina* Linnæus, Female.
2. *Spharagemon bolli* Scudder, Female.
3. *Trimerotropis maritima* Harris, Female.
4. *Schistocerca americana* Drury, Female.
5. *Schistocerca alutacea* Harris, Female.
6. *Schistocerca rubiginosa* Harris, Male.
7. *Melanoplus scudderi* Uhler, Female.
8. *Melanoplus femur-rubrum* De Geer, Female.

Plate IX

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PLATE X.

1. *Melanoplus atlanis* Riley, Female.
2. *Melanoplus bivittatus* Say, Female.
3. *Paroxya floridana* Thomas, Female.
4. *Scudderia curvicauda* De Geer, Male.
5. *Amblycorypha oblongifolia* De Geer, Male.
6. *Conocephalus ensiger* Harris, Female.
7. *Conocephalus robustus* Scudder, Male.
8. *Conocephalus triops* Linnæus, Female.
9. *Xiphidium fasciatum* De Geer, Male.

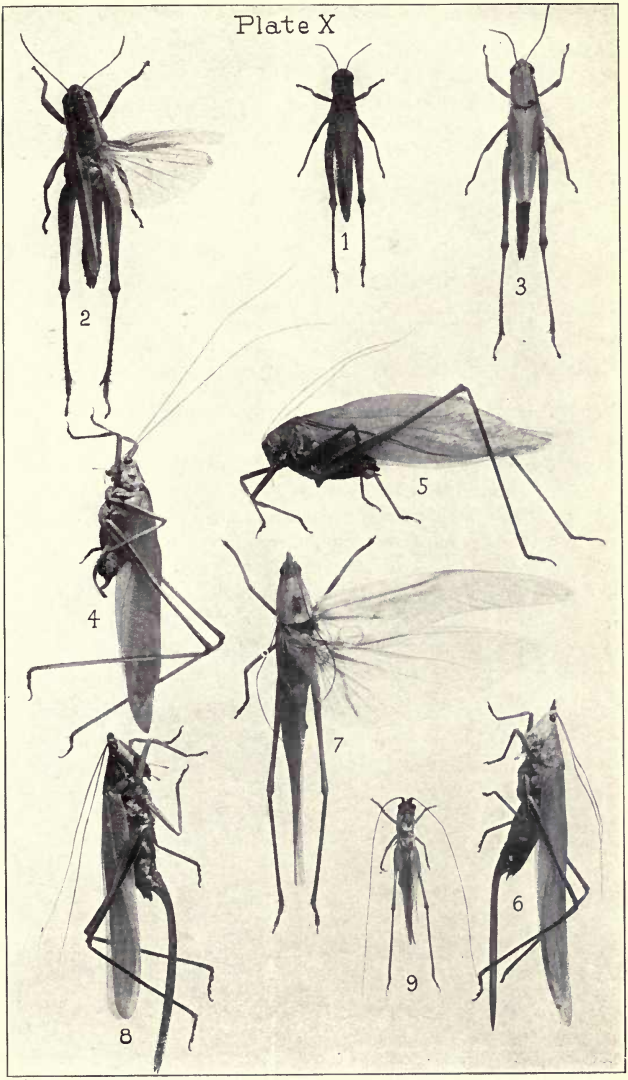
Plate X
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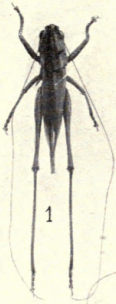
PLATE XI.

1. *Orchelimum vulgare* Harris, Female.
2. *Atlanticus pachymerus* Burmeister, Male.
3. *Ceutophilus.*
4. *Gryllotalpa borealis* Burmeister, Male.
5. *Tridactylus terminalis* Uhler.
6. *Nemobius fasciatus* De Geer, Female.
7. *Nemobius fasciatus* De Geer, Male.
8. *Gryllus abbreviatus* Serville, Female (form *luctuosus*).
9. *Œcanthus angustipennis* Fitch, Male.
10. *Œcanthus angustipennis* Fitch, Female.
11. *Œcanthus fasciatus* Fitch, Female.

Plate XI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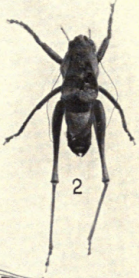
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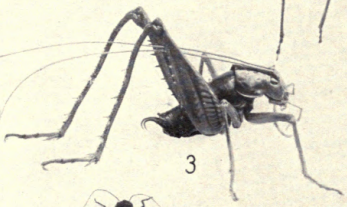
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